Electrical World

A McGRAW-HILL PUBLICATION

MAY 10
1947

Features

Young Engineers Needed

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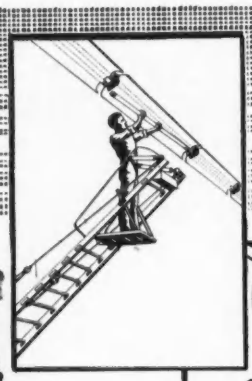
Do Complicated Rates Hamper Power Selling?

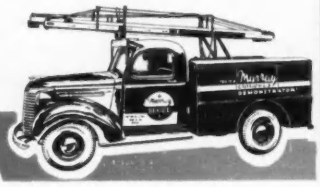
Neutral Grounding—A Way to Limit Faults

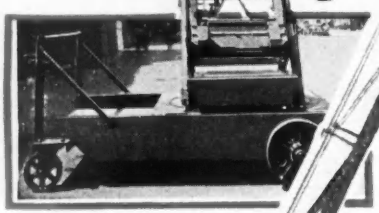
Modern Ball Park Lighting

"High, wide" — yes, and "handsome", too!

The ladder that never interrupts production







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Here are 96 more Questions and Answers!

Q. What is the Oilostatic Transmission System?

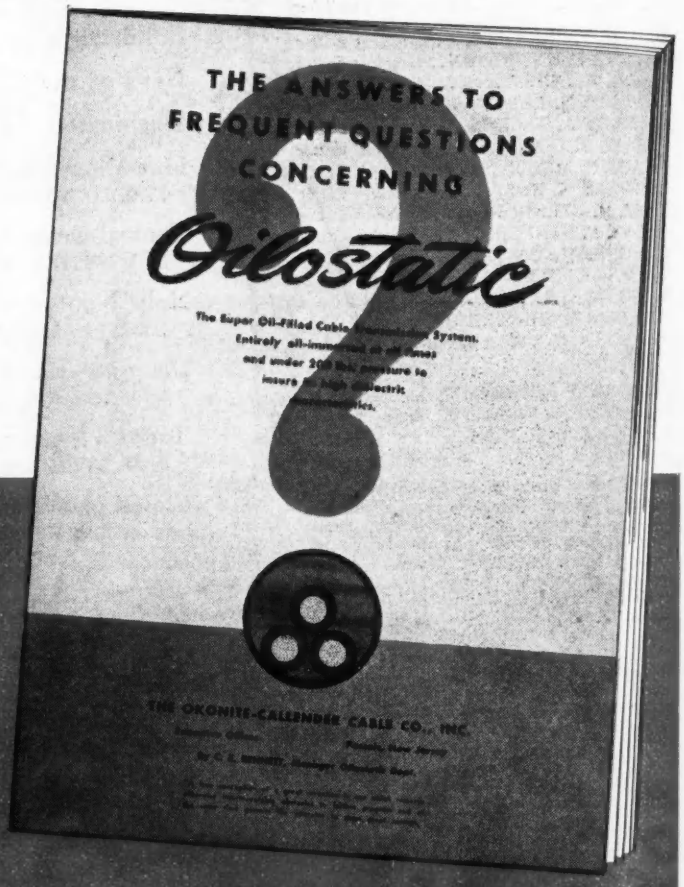
A. *The Oilostatic Transmission System is an oil-filled cable system which uses non-leaded power cables installed under 200-lbs. oil pressure in welded steel pipe lines.*

Q. What is the value of the Oilostatic System?

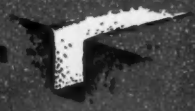
A. *Savings from 15% to 50% in initial cost, quick installation, ease of getting around physical obstructions, extremely high factors of electrical and mechanical safety. No cable failure has occurred on an Oilostatic System since introduced 15 years ago.*

Q. Where can I find out more about the Oilostatic Transmission System?

A. *By consulting an Okonite-Callender engineer or by writing on your business letterhead for Bulletin OK-1025. The Okonite-Callender Cable Company, Inc., Executive Offices, Passaic, New Jersey.*

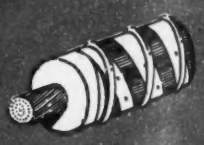


The Oilostatic Transmission System requires only these steps: . . . digging a narrow trench



. . . placing in it a welded steel pipe

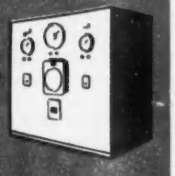
. . . pulling in solid type paper-insulated cable



. . . then connecting easily-made joints

and potheads

. . . installing a prefabricated pumping unit and reservoir



. . . applying 200 lbs. oil pressure for operation up to 230,000 volts.

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Electrical World

MAY 10, 1947

Loose Talk About Prices

THE PRESIDENT has plowed into the price problem in a way that may do as much harm as good. He has attacked all prices, with the clear implication that all are unnecessarily high. This not only is incorrect; it may damage the consumer as well as the producer.

No one will deny that some prices are out of line and should come down. But many others —including most electrical items—have risen only to the extent or even less than costs have advanced. These prices can only back down if costs are lowered. And if, as is now the case, costs be increased once again, these prices of necessity will be pushed higher.

There is considerable misunderstanding and loose talk about the nature of the price advance this past year. Economists of the future undoubtedly will find that the general price level rose permanently. This has happened after every major war with good reason. Concurrently, however, 1946-47 developed many price distortions. Some prices climbed to levels unsupportable either by considerations of cost or demand. It is these prices that will decline substantially. Most electrical goods are not among them.

A Department of Commerce study in the "Survey of Current Business" illuminates this question. It shows that farm and food prices (up 94 percent and 85 percent since 1941), cotton textiles (up 83 percent), and lumber (up 108 percent) are among those that have far outstripped other prices. Conversely, prices of most metal products have lagged considerably behind the rise in wage rates.

As to electrical manufacturing, here are typical price increases from mid-1941 until early this year: power transformers, 8 percent; oil switches, 14 percent; turbo-generator units, steam, 19 percent; distribution transformers, 28 percent; boiler plant equipment, 35 percent. These fall far below the average price increase for all manufactured commodities, some 51 percent, and they lag considerably behind the advance in wage rates.

It is the dramatic rise in labor costs that has carried apparatus prices higher. Even before the most recent wage agreements, hourly earnings in electrical manufacturing had climbed 54 percent since late 1941. Moreover, raw material suppliers have faced a cost situation as bad, if not worse. Their charge to electrical manufacturers has gone up accordingly.

Thus it is hardly likely that prices of most electrical apparatus could be reduced substantially. Whatever hope buyers might have entertained certainly will disintegrate under the impact of the most recent wave of wage boosts. In electrical manufacturing, these push the wage advance since 1941 up to 73 percent. Higher prices, rather than lower, is the inevitable outcome of this move.

★ ★ NEWS OF THE

FPC Head Calls on Congress to Set Federal Power Policy

Nelson Smith in Address to National Rivers and Harbors Congress Points Out Inconsistencies in Present Federal Laws—Criticisms Would Be Ended by Dondero Bill Passage

CONGRESS must decide, once and for all, whether the federal government is to plunge up to its neck, continue to dabble one foot, or drop all interest in the electric power business. Then it must establish a clearly defined policy for carrying out this decision, a policy which both federal administrative agencies and private industry will understand and accept.

These recommendations were advanced last week by Nelson Lee Smith in his first major public address on power matters since he became chairman of the Federal Power Commission last December. His statement was concrete evidence of previously reported concern within the commission over the national power policy, or the lack of one.

Speaking before the convention of the National Rivers and Harbors Congress in Washington, Chairman Smith refused to link his remarks with any corrective legislation now before Congress, but his criticism of federal power operations was directed at the same points which the Dondero Bill (ELECTRICAL WORLD, April 26, Page 37) and other current legislative proposals seek to amend.

He pointed out that Congress recognized the nationl interest in power development by enacting two general types of laws: (1) the Federal Water Power Act of 1920 and amendments, establishing FPC to supervise power development on navigable streams and public lands, and the coordination of power systems; (2) public works laws, which put several administrative agencies into construction and operation of hydroelectric projects.

But FPC's controls, Chairman Smith noted, "have more direct application to developments undertaken by private capital and by state and local authorities than to those . . . of the federal government itself". In this respect, the will of Congress is "less clear and well-defined."

For example, the Army Engineers build and operate power plants on the basis of their own and FPC recommendations. Energy generated at these plants is marketed by the Secretary of Interior at rates approved by the commission. But there is far less FPC influence over the operations of Interior's construction agencies.

The Reclamation Bureau, as authorized by Congress, independently determines what power facilities will be installed at its projects, what transmission lines it will build, the power rates, and "all other aspects of its power development and marketing program." Southwestern Power Administration, selling energy from Army-built projects, submits its rate schedules to FPC. Bonneville Power Administration consults the commission as to rates for Bonneville dam energy but not on the output of Grand Coulee and other projects built by the Reclamation Bureau. Still another agency, TVA, constructs and operates power plants free from review by any other federal agency.

Congress has granted varying measures of operating independence to each of the construction agencies. TVA has been able to build transmission lines and steam generating systems. Bonneville Administration has been permitted to construct some transmission lines, but no interior agency has been granted funds for federal steam stations or for extensive transmission systems.

A "more consistent pattern of treatment" of federal power project operation and administration would resolve at least three major problems, Chairman Smith contended. It would end uncertainties as to power supply in areas where federal power projects are built or proposed; it would improve the negotiation of contracts with prospective purchasers of federal energy; and, "perhaps", it would allay "some of the suspicion with which the advocates of public and of private power regard one another, thus tending to promote a more favorable atmosphere for sound power development from a truly national point of view."

Must Provide Needed Capacity

Specifically the FPC chief urged the government to "face squarely the responsibility for providing all or a substantial part of the additional generating capacity needed" in areas where it is the predominent source of power supply, such as the Pacific Northwest. Secondly, the question of federal transmission line construction should be clearly answered.

This problem, he added, has devolved into a simple question as to whether "federal generating facilities (are) to be integrated into the existing power production and transmission facilities," or "competitive, federally-owned lines (are) to be provided to reach all prospective utility and industrial customers." If interconnections with existing transmission system are to be provided, "common carrier operations" might be necessary in some cases "to carry energy for small public systems unable to build to the federal source of supply."

Finally, the government should make known "without undue delay" what its

Columbia River Flow Gets Less and Less

The flow of the Columbia River, a popular one for public power projects in the Northwest, is growing less and less each year. Since records were first kept in 1858, the peak flow has decreased from 733,000 cu.ft. a second in the first decade to 428,000 cu.ft. in the last eight years. An engineer for the U. S. Geological Survey added that the total yearly flow is also decreasing but that he could give no explanation. He said that other streams in the region also show smaller flow and that irrigation and timber cutting are not to blame.

"long-run intentions are regarding the electric power field."

"Is it," Chairman Smith asked, "going to make further inroads into the power business as an operator, or is it going to permit—except where it is already established in the business—the private power industry to carry on as a regulated utility enterprise, aided and encouraged to meet our national requirement regarding such matters as water-power conservation and development and the coordination of system operations in the interests of both national defense and an abundant normal power supply at reasonable cost to the consumer—?"

Once Congress has determined power policy along these lines, "it is then the duty of the administrative agencies to apply them as honestly and efficiently as possible. Equally, it is the obligation of the power industry to cooperate in an effort to make the national program effective."

•

Arkansas Utility Orders Units for Lake Catherine

Arkansas Power & Light Co. has ordered two 40,000-kw. turbo-generators for installation in the partially completed Lake Catherine power plant near the Jones Mill Aluminum Reduction mill in Arkansas, which the company has purchased from the government for $925,000.

Most of the output from the plant, which the power company will complete at an additional investment of about $8,000,000, will be used to supply power to the Reynolds Metals Co., which has leased the Jones Mill plant. Two potlines at the aluminum mill are operated from direct current generators installed at the mill, and power from the new steam-electric station will be used to operate the other two potlines.

Operation of the Lake Catherine station is scheduled for late in 1949. Changes will have to be made in the original design of the power station because the units to be installed are larger than those for which the plant was designed. The plant will use water from the utility's Lake Catherine, created by its Remmel hydroelectric station, for its condensers. The building is big enough for addition of a third unit later.

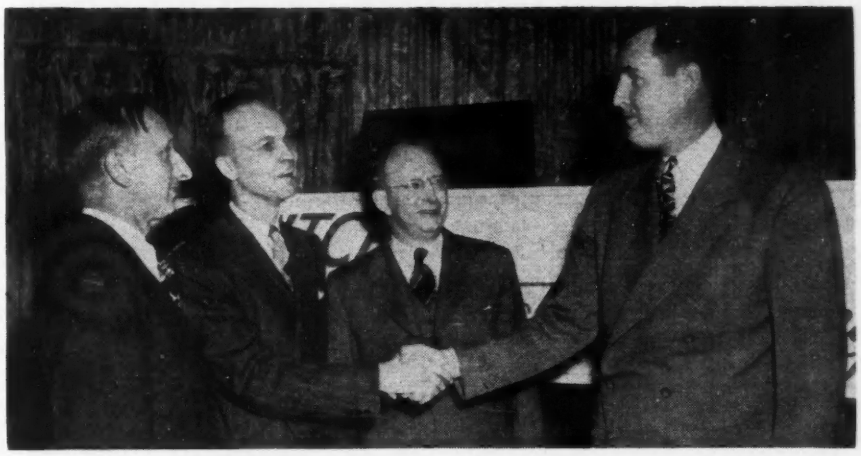
E.E.I. Engineering and Safety Groups Convene at Chicago

Accident Prevention Committee Told Fatalities Decrease but Assistance of Engineers Would Cut Down Accidents—Use of Aluminum to Replace Copper Conductor Discussed

KNOW-HOW of the engineers is earnestly solicited by those engaged in accident prevention because it can be a large factor in the industry's effort to continue improving its steadily bettering record of fatalities. This was the theme of a joint session of the Edison Electric Institute's Transmission and Distribution Electrical Equipment, and Accident Prevention committees in Chicago during sessions on April 28-30. Details of a 138-kv. H-frame line, experience with corroded connections, and the scheme of a new 300,000-kva. substation on the Consolidated Edison (New York) system were other features of the sessions. Total registration was over 280.

Engineers could contribute substantially to accident prevention if they would familiarize themselves with the reactions of operating people to the matter of unsafe working conditions. This was an assertion of D. C. Stewart, chairman of the Accident Prevention Committee, in reviewing the five-year record of fatal accidents in the electric utility industry for the benefit of the engineering committees. Its record is slightly better than average industry as to frequency but somewhat poorer as to severity. There has been a 75 percent reduction in 23 years in both fatalities and lost-time accidents. However there has been since 1939 a persistent rise (2.1 to 3.0) in lost-time accident rate. Of 472 fatalities in 5 years, linemen incurred 261 and power production employees 74. Shock and burns account for 70.5 percent of the total.

Unsafe working practices are few in number, Stewart said, but are persistently repeated. He added that operating men should not regard accident prevention as a hindrance to production and that departments with the best accident records usually turn out the



COOKING SPECIALISTS—Four of the 75 commercial cooking specialists who attended the recent electric cooking forum at the Stevens Hotel, Chicago, get acquainted. Left to right are Walter Kant, Wisconsin Electric Power Co.; J. G Snyder, Ohio Power Co.; Walter Schultz, Ohio Public Service Co.; and Arnold Miller, Cleveland Electric Illuminating Co.

most work and have fewest grievances. In a discussion, H. S. Fitch, West Penn Power Co., said he questioned whether engineers and management are doing all that they could do to abet the excellent efforts of the accident prevention groups.

Two large metropolitan utilities with accident records far better than the industry average detailed the procedures and functioning of their safety departments. Consolidated Edison has one-third the industry's rate on electrical fatalities, and W. F. Brown said it was possible to show that one of the safest jobs in all industry is in working for an electric utility. He said the secret of success with rule books is to confine the requirements to surely enforceable ones. Field collaboration with crews on the part of safety advisers is welcomed and sought by supervisors rather than resented.

Informative analysis of 271 classified fatalities due to electric shock and burns by A. L. Dowden of Liberty Mutual Insurance Co. was viewed as an excellent piece of educational literature for preventive work. The tabulations segregate the work as to voltage class and location of the employee (on the pole or on the ground), the nature of this employment, and the circumstances of the happening.

Crane Contacts a Problem

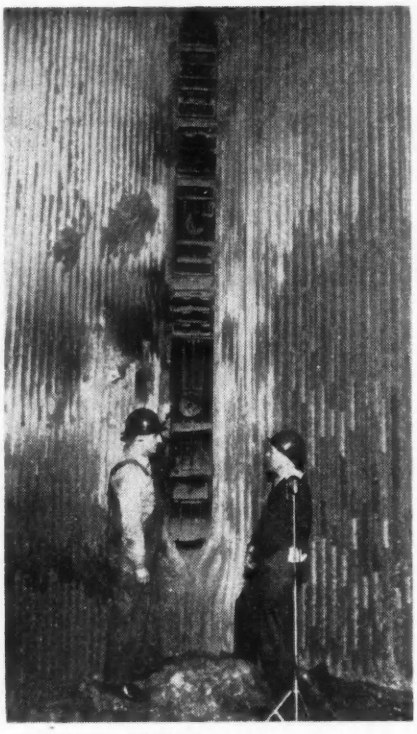
Prevention of crane contacts with live circuits was considered an elusive and baffling problem. It was discussed from the ordinance and permit angle as well as the merit of instituting action when an operator interferes with utility service. It was brought out that many states have anti-tampering statutes which might be invokable. W. R. Smith, Public Service Electric & Gas Co., Newark, reported accumulation of data from 57 companies in 28 states; concensus was that some form of ordinance is desirable.

Neoprene coated rubber gloves are in prospect, said T. R. Chaffy of W. H. Salisbury & Co., as something affording improved corona-cutting resistance without sacrificing prevailing attributes of conventional rubber. Tests are still to be conducted on the mechanical and physical characteristics, and then test procedures will have to be standardized. He foresees improvement in the quantity and quality of rubber available for fabricating protective equipment.

Much confusion exists in medical circles about the best way to treat electrical burns, and the committee will seek some channel for clarifying the issue.

Present shortage of copper for conductors was reflected in a general discussion of aluminum as an alternative for many purposes. No one was able to answer the primary question of time, whether the present situation is an emergency and temporary condition or of longer range. Mention was made of the objections that have been raised to aluminum as conductors in service entrances, chiefly due to connections at meters and switches. It developed that aluminum has been used for service drops in some places, but no installations have been reported on distribution secondary mains or primaries. Shortage of steel has created a heavy backlog in ACSR, which is about as severe as the shortage of heavy stranded copper. (ELECTRICAL WORLD will shortly run a series of articles on the technology of applying aluminum conductors in industrial and utility circuits.)

R. M. Havourd, Public Service Electric & Gas, reported tests on mechanical connectors used on stranded conductors. He concluded that any of the tap connectors is satisfactory for normal load current, but none is suitable for heavy fault currents if the wire is corroded or is not clean. Separating the conductors in the connector by a spacer is desirable and a corrosion inhibiting grease should be used on cleaned outer strands at the connection. In discussion it developed that most connector troubles have been on stranded, not on solid wire, and that twist or compression sleeves should be used as with ACSR.



BOILER BROADCAST — George Hicks, right, "Around the Town" reporter on the radio program of Consolidated Edison Co., New York, discusses boilers with A. Connal, watch engineer at the Sherman Creek plant of the utility, prior to making a broadcast from one of the big boilers at the plant which was down for repairs

Bearing plates, pole bands, and crossarm clamps feature X-braced H-structure pole lines being built by Central Illinois Public Service Co. T. N. Cofer and A. J. Borchers, in describing this new type construction said that elimination of gains, grooves, and bolt holes would act to retard decay, avoid splitting and reduce burning due to leakage currents. Tests of the bearing plates showed they are effective in preventing overturning or vertical movement of the poles, and thus permit use of the full strength of the structure.

W. McLean, Consolidated Gas, Electric Light & Power Co., Baltimore, showed lightning storm records of a ten-year reduction in distribution transformers damaged from 1.5 to 0.4 percent and fuses blown from 10.6 to 2.4 percent. Interconnection of grounding and investigations made after cases of trouble helped in this improvement, and they are now using common neutral plus good grounding. T. H. Haines, Boston Edison Co., commented that testing and particular attention to individual grounds are no longer necessary with extensive interconnection and common neutral.

There was considerable lack of enthusiasm for the 30-ft. mounting height for street lights proposed by I.E.S. as explained by W. H. Edman who presented that association's viewpoint.

A.I.E.E. Report Interpreted

Resume of the progress of the A.I.E.E. insulation resistance subcommittee was presented by R. L. Webb of Consolidated Edison including interpretation of the provisions of the A.I.E.E. No. 43 report recently distributed for comment.

The open ring bus of substation designs set down for use in expansion plans of the Baltimore system attracted considerable interest. W. M. Hanna described it as a basically one-breaker-per-feeder scheme with incoming cables tied solidly to the TCUL 3,750-kva. transformers. Also in the Electrical Equipment Committee session, A. M. deBellis detailed the new 300,000-kva. Consolidated Edison substation in Jamaica which will have a 150,000-kva. tie to Long Island Lighting's Valley Stream substation. Feed will be at 132 kv. and delivery at 27 kv. from a 4-section bus without sectionalizing in feeder reactors. Oilostatic cable will be used for the 132-kv. ties and gas-filled for the 27-kv.; the 27-kv. bus will be metal clad with phase isolation.

Interior Agencies Readjusting to Conform with Budget Cuts

Reclamation Bureau Planning to Reduce Personnel in Field Offices—Division of Power Will End Activities June 30 Unless Senate Grants Funds—SPA Will Continue as Usual

INTERIOR Department agencies, including most of those dealing with power operations, began planning revised schedules of activities this week to conform with reductions made by the House in the department's annual budget for fiscal 1948.

Hardest hit was the Division of Power, all funds for which were eliminated from the Interior bill. Unless some of its funds are restored by the Senate, the Division will close up shop on June 30. The Bureau of Reclamation also was planning to reduce personnel, chiefly in its field offices. The only unscathed agency appeared to be the Southwestern Power Administration, which kept its administrative funds and all major construction projects under the House bill.

Discussion of the Interior Appropriations Bill opened on the Senate floor soon after the House completed action on it. And there was evidence that the Reclamation Bureau, at least, probably would gain increased funds. Sen. Styles Bridges, chairman of the Appropriations Committee, and Sen. Robert Taft promised to give "further consideration" to important irrigation projects.

Must Shift Division's Functions

While no official announcement was made by Interior, it was apparent that present functions of the Power Division necessarily would be shifted to surviving agencies dealing with energy production—Reclamation, Bonneville and SPA. Legislative provisions of the House bill specifically forbid the creation of any new office under the Secretary to take over the Division's functions. Since the fields of operations of the remaining three Interior power agencies are strictly limited, this leaves in question the manner in which the Secretary will market energy from Army-built projects in other sections of the country, as prescribed by Section 5 of the 1944 Flood Control Act. This was a function scheduled for the Power Division.

Major complaint of the Reclamation Bureau was the slash in funds for planning future power and irrigation projects. In addition to reducing the allotment for engineering and economic investigations from $5,000,000 to $125,000, the House cut the amount available for the Bureau's Denver engineering office to $6,500,000. The latter office has been operating on an annual budget of approximately $10,500,000 and is expected to discontinue much of its work on preliminary surveys unless additional funds are forthcoming.

Estimating reduced construction in proportion to reduced dollars, it appears that only 80,000 kw. of new capacity will be installed by the Bureau in fiscal 1948, as against planned installation of a total of 629,000 kw. Much of this new capacity will be lost on California's Central Valley project, where addition of 300,000 kw. had been planned for next year. Using the dollar reduction formula, only 75,000 kw. of new capacity could be installed at this project.

Other major power projects likely to be slowed include Fort Peck, Mont. Reduced funds will permit the continuation of construction on the Fort Peck-Glendive and Fort Peck-Williston transmission lines, but no money is available for substations in connection therewith. At least a year's delay is in prospect for completion of the Davis Dam, Ariz., power plant with its 90,000 kw. in new capacity.

The Hungry Horse, Mont., project, the Colorado-Big Thompson, Colo., project and Kortes Dam, Wyo., together with their hydroelectric generating plants, also would be delayed.

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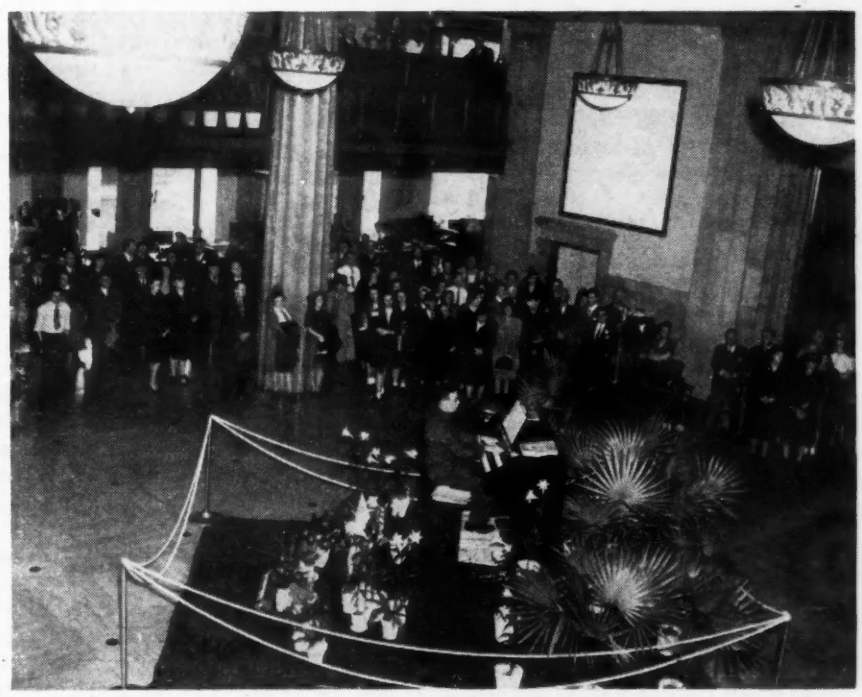
Savannah Electric Asks Court for Return of Land

The federal court has been asked by the Savannah River Electric Co., affiliate of Georgia Power Co., to set aside government acquisition of 1,307 acres of power company land at the site of the Clark Hill multi-purpose project on the Savannah River near Augusta.

The utility contends that the federal court order last December, which gave the government possession of the land, violates both the United States and Georgia constitutions. The company contends further, in resisting condemnation, that the land value of its holdings has a electric power development value of more than $2,000,000. The company has 39,500 acres.



CATHEDRAL-LIKE—The huge lobby of the main building of the Cincinnati Gas & Electric Co. in Cincinnati took on a church-like air during Holy Week as Pat Gillick, who has been associated with the Cincinnati Symphony Orchestra, gave daily concerts of sacred Easter music. Two local choirs sang the hymns

Better Accounting Ways Needed to Reduce Costs

S.E.E. Accounting Conference Discusses Problems Affecting Operations of Electric Utilities

That an improved system of accounts, with a number of changes in procedures and methods is needed to simplify and make less costly the keeping of utility accounts, was the general opinion expressed at the Accounting Conference of the Southeastern Electric Exchange, held April 17-19, at Miami Beach.

H. E. Simpson, vice-president and controller of Florida Power & Light Co., expressed the opinion that within the next two or three years changes might be effected in the FPC system which was adopted by the SEC so as to relieve such drastic provisions as are now included in the system as written. He referred specifically to accounts 100.5 and 107 and the related accounts, instructions, regulations and interpretations.

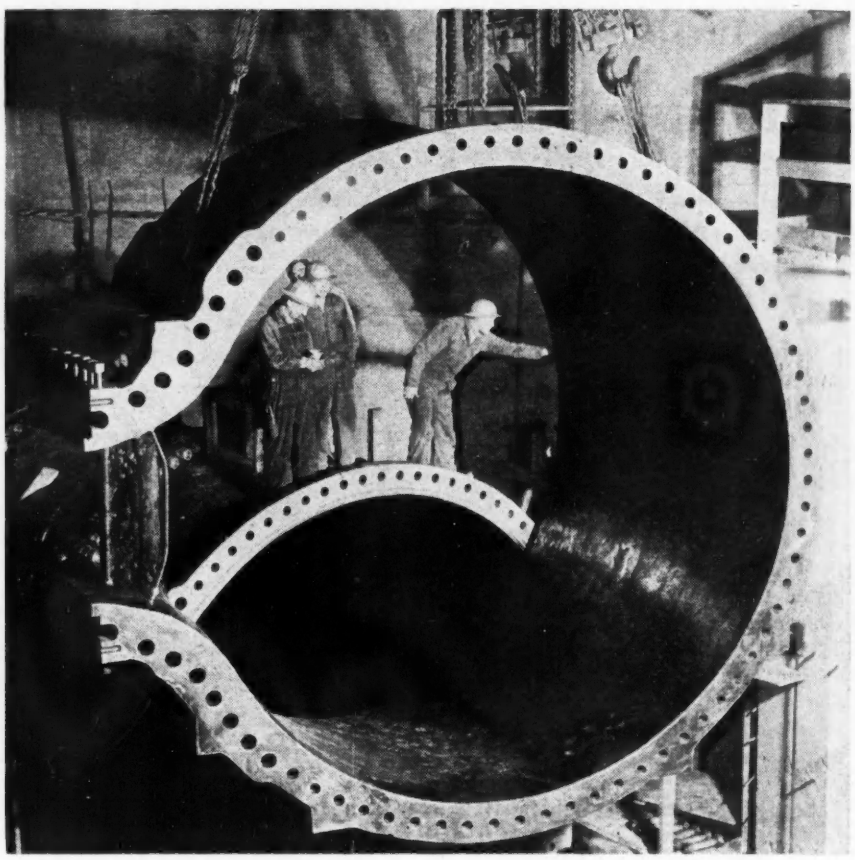
Simpson stated that any changes will come from accountants in the utility industry who work for them and present sound arguments for modifications and real simplifications.

With most utilities faced with large-scale financing problems, accounting changes will be needed to allow for basis of short-term borrowings while long-range plans are being perfected. SEC ratios of the classes of stock to bonds for financing should not be too rigid, in the opinion expressed by some accountants. Simpson said that SEC has under consideration a plan for liberalizing its policy with respect to the limitations on unsecured debt as a means of assisting utilities in raising funds for expansion and new construction.

Textbook Accounting Useless

H. C. Hasbrouck, accounting director for E.E.I., described the methods of functional accounting and said that no company can get a system of functional accounting out of a textbook or manual and put it into effect with assurance of success. He said the system must be tailor made to fit the conditions of the individual organization.

Monongahela Power Co. has obtained exeellent results from its system of having a representative live within the area of 600 to 1,000 customers, do the meter reading, repair line breaks, and do other customer service, said C. H. Leatham, vice-president. His company believes that reading meters each month presents added opportunities for customer contact. He said the system, which has worked so well in rural areas, is now being applied to urban areas.



PROGRESS AT COULEE—Workmen lower into place a 27-ton section of the scroll case for the first of three 108,000-kw. generators which are being installed in the West powerhouse at Grand Coulee Dam

W. E. Elliott, assistant purchasing agent for Virginia Electric & Power Co., was of the opinion that closer and more accurate physical control should be exercised over material and supplies. He felt that all equipment should be standardized to lessen the number of stock items, which would reduce costs and make purchasing more economical. Elliott stated that central storerooms could serve the entire system more efficiently now with so many critical and hard to get items in great demand.

Considerable study is needed in making determination of earnings and amortization reserves of federally licensed hydroelectric projects, in the opinion of W. J. Ready, controller for South Carolina Electric & Gas Co. After analyzing present systems and regulations he pointed out the need for further research and exchange of ideas. He said that it was improbable that a formula could be devised which would be appropriate in all cases.

R. E. Howard, general auditor for Alabama Power Co., strongly urged continued development of employee-customer relations. He described methods used by his company to train personnel of the cashier and accounting departments in presenting good relations in their contact with customers.

15,000 Salaried Employees of Westinghouse Get Raise

Westinghouse Electric Corp. this week awarded wage increases averaging $5 weekly to over 15,000 salaried employees. The new pay schedule was covered in a contract negotiated and signed with the Federation of Independent Westinghouse Salaried Unions.

The new salary schedule gives persons earning under $200 per month a $4.85 weekly raise; between $200 and $310 monthly, a $5 increase, and those receiving over $310, a 7 percent raise. In addition to wages, other benefits include a three weeks' vacation for employees with 20 years' service

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Co-op to Build Plant

Central New Mexico Electric Cooperative, Inc., will erect a 900-kw. diesel generating plant at Corona, N. M. Funds for the plant and 401 miles of distribution lines were provided by a $707,500 loan recently obtained by the co-op from the Rural Electrification Administration. The co-op will serve retail consumers in Torrance County and part of Lincoln County.

Utilities Buying Transmission Facilities of 2 Cooperatives

Kamo Electric Cooperative Offers Its Uncompleted System to Business-Managed Firms for $991,500—California Co-op also Selling 'Paper' System to 2 Privately Owned Utilities

UTILITY COMPANY purchases of generating and transmission facilities owned by rural electric cooperatives, plus company rate reductions to co-ops planning to build such facilities, are rapidly assuming the proportions of an industry-wide program.

Latest of such developments are the negotiations for the properties of a generating co-op in California and a transmission co-op in Missouri and neighboring states. Both deals were reported in advanced stages this week.

Similar activities of recent date include the purchase of the Ark-La transmission line by a group of Southwestern utilities and the offers by Alabama and Texas companies of reduced rate schedules and increased power supplies to cooperatives planning the installation of new generating capacity in those areas. The latter offers are still hanging fire.

7 Utilities Involved

Empire District Electric Co. and a group of neighboring utilities are studying an offer by the Kamo Electric Cooperative, Inc., of Neosho, Mo., to sell them its partially completed transmission system for a total of $991,500. Terms of this proposal include a 35-year contract to supply energy to the 16 distribution co-ops now served by Kamo. All companies now selling energy at wholesale to the co-ops—Empire District, Oklahoma Gas & Electric Co., Southwestern Gas & Electric Co., Arkansas Power & Light Co., Public Service Co. of Oklahoma, Missouri Public Service Co., and Oklahoma Power & Water Co.—would be parties to the contract and, apparently, would divide the Kamo properties.

According to Kamo officials, the purchase price would cover the co-op's entire indebtedness to the Rural Electrification Adminstration, including interest. Kamo owns approximately 188 miles of transmission lines in various stages of construction, with 24.13 miles of 66-kv. line and the remainder of 44-kv. capacity. Other properties include a warehouse at Seneca, Mo., leases on pole yards, and considerable stocks of equipment and line materials.

The Kamo offer set no rates for energy to be supplied its member co-ops by the utilities but warned that the companies' rate proposals would be compared with costs of "alternative sources of power available." In addition, the proposal called for construction by the companies of substations necessary to deliver power to the co-ops, with the utilities making available future energy supplies at whatever points and in whatever quantities the co-ops and REA deem necessary.

Meanwhile, purchase of the Mesa Electric Cooperative of Phelan, Calif., was virtually concluded by California Electric Power Co. and Southern California Edison Co. A year-old organization, Mesa had not yet completed any of its planned construction, including 198 miles of distribution lines and a $225,000 generating plant. The purchaser companies were prepared to assume its total indebtedness to REA, which amounted to $90,811.45. The companies would take over all materials purchased or contracted for by the co-op.

Reports that another California co-op, the Plumas-Sierra Rural Electric Cooperative of Portola, was considering sale of a portion of its sprawling distribution system were denied by REA. Pacific Gas & Electric Co. made an offer for this property, it was reported.

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Voters Approve Franchise

The Mississippi Power Co. has been voted a 25-year franchise by the citizens of Hattiesburg.

It's Hoover Dam Again

From the time of its construction until 1933, when Harold L. Ickes became Secretary of the Interior and renamed it, Boulder Dam was known as Hoover Dam in honor of the president. Last week, President Truman restored the original name by signing a bill which had met little opposition from either party in Congress.

Pyle Advises Wholesalers That Inflation Must Lose

Expressing the belief that the electrical industry will be out in front in the fight on inflation, Charles G. Pyle, managing director of the National Electrical Wholesalers Association, this week warned the members at their annual convention at Atlantic City that,

"The challenging fact is that most goods and services have been pushed. booted, and inflated out of reach of the one single objective all of us must reach, the buyer's pocketbook."

He added that some producers have already seen the light and are reducing prices and that if inflation comes it will be a direct result of our internal economic strife, and we will reap the depression.

After asserting that the nation's entire economy today is facing the greatest challenge in its history, Pyle said that he believes the challenge will be met but stressed that "the battle is for distribution. We will sell and distribute and consume as we never have before—or else."

Pyle claimed that the electrical industry will be out in front fighting inflation. "It is nothing we have not done before. To provide more and better products at less cost has been the electrical industry's proud achievement in the past, and we can do it again."

He also outlined the four-point program adopted recently by the association to sell 50 percent more goods and services than in pre-war years. The program calls for the hiring of more sales personnel, selection of better salesmen, more training for these workers, and indoctrination of all employees to do a better job.

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Foremen's Unit at General Cable Certified by NLRB

In one of its first foremen decisions since the Supreme Court upheld the status of foremen's unions in the Packard Case, the National Labor Relations Board certified the International Brotherhood of Electrical Workers, A. F. L., as bargaining agent for 13 foremen at General Cable Corp.'s Bayonne, N. J. plant. NLRB has resumed consideration of foremen disputes following the Packard decision but is not proceeding on any new ones until after May 15.

In other recent actions, NLRB has directed representation elections at:

Central Ohio Light & Power Co., production and maintenance employees, in-

cluding foremen who have no control over the men under them, requested by the Utility Workers Union, C. I. O.

General Electric X-Ray Corp., Chicago, among production and maintenance employees, requested by United Electrical, Radio & Machine Workers, C. I. O. International Association of Machinists, A. F. L., which holds present contract, also will be on ballot.

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Vandenberg St. Lawrence Bill Introduced in Senate

The St. Lawrence Seaway project gained the most important Senatorial backing of its long and controversial history this week when Sen. Arthur Vandenberg, Michigan Republican, introduced a bill calling for approval of the 1941 agreement between the United States and Canada for its construction. The bill has been sent to the Foreign Relations Committee, of which Vandenberg is chairman.

The new measure, co-sponsored by 15 Senators and 15 Representatives, is expected to encounter little delay in reaching the Senate floor. But a quick check of party leaders indicated that the proposal stood little chance of passage in the economy-minded House, at least during the present session of Congress.

Stripped of all construction features except the navigation and power projects, Senator Vandenberg's version of the agreement also directs the State Department to enter into negotiations with the Canadian Government for the imposition of shipping tolls on the seaway once construction is underway. Senator Vandenberg also revealed that the two governments already have held informal conversations regarding tolls and that the Canadians have indicated their approval.

The tolls, he added, would be applied only to those segments of the river deepened as a result of new work and not to the present 14-ft. channel already in operation. The details are to be worked out later by the two governments.

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Province Can Run Mines

The New Brunswick provincial assembly has passed a law empowering the government to take possession of strike-bound soft coal mines and operate them to supply coal for the biggest steam generating plant in the province, the 30,000-hp. Grand Lake plant of the New Brunswick Electric Power Commission.

Behling Appointed to FPC; Health Forces Sachse Out

Early Senate confirmation of the nomination of Burton N. Behling as a member of the Federal Power Commission appeared probable at mid-week. No serious opposition in either Congressional or industry circles had developed since the President announced the appointment on Monday.

Only criticism of the naming of the 41-year-old Behling to fill the unexpired term of ailing Commissioner Richard Sachse and a subsequent five-year term was mild and originated among industry sources. These spokesmen expressed disappointment at what they termed the appointee's "lack of experience." A protege of FPC Chairman Nelson Lee Smith, the nominee has been a member of the commission's staff since September, 1944, and has been engaged in work involving the natural gas industry.

A native of Oshkosh, Wis., Behling is a graduate of Lawrence College, Appleton, Wis., and received his master's and doctorate degrees in economics from the University of Illinois. From 1931 to 1939, he was a member of the faculty of the latter university in the Economics Department.

He served as an analyst and investigator for the Interstate Commerce Commission from 1939 until his appointment as an economics consultant with FPC. In October, 1945, he became a special assistant to the Federal Power commissioners and in December, 1945, was named director of the commission's natural gas investigation.

The White House announcement of the Behling appointment revealed that Commissioner Sachse, now recuperating in California, had advised the president that his health would not permit his return to duty with FPC.

SEC RULINGS

The Securities and Exchange Commission recently issued a series of orders affecting electric utility companies.

MISSISSIPPI POWER & LIGHT CO. has been authorized to sell 250,000 additional no par common shares to Electric Power & Light Corp., parent, for $2,500,000. Mississippi Power & Light Co. will use proceeds to partly finance construction program. (Release No. 7339).

NORTHERN STATES POWER CO. (Wis.) has been authorized to sell $19,000,000 of first mortgage bonds at competitive bidding, and to sell to parent Northern States Power Co. (Minn.) 5,201 shares of $100 par common stock at par. Funds will be used to redeem $16,975,000 outstanding 1st 3s, due 1964. (Release No. 7348).

MIDDLE WEST CORP. has been conditionally granted an extension until June 14 in which to divest itself of common stock holdings in Central & South West Corp. Middle West, in applying for an extension until June 30, advised the SEC that it planned to distribute the stock to its own stockholders about June 14 on basis of one share of Central & South West Corp. for each share of Middle West held. In extending allotted time for divestment, the SEC stipulated that Middle West Corp. would have to cause adjournment of annual meeting of Central & South West Corp. from April 15 to August 15, the latter date being subsequent to Middle West's divestment of interest in this subsidiary. (Release No. 7352).

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Farmers Want Power

Calgary Power Co. is completing negotiations with 140 farmers on the south side of the Bow River between Calgary and Cochrane for the electrification of all farms and ranches in that area. The cost per farm is expected to total around $720.

MEETINGS

Previously Listed

Southeastern Electric Exchange—Home Service Conference, Thomas Jefferson Hotel, Birmingham, Ala., May 13-14.

Pennsylvania Electric Association—Prime Movers Committee, Castleton Hotel, New Castle, Pa., May 15-16. Transmission & Distribution Committee, Irem Temple Country Club, Dallas, Pa., May 22-23.

American Public Power Association—Annual Convention, Hollenden Hotel, Cleveland, May 21-23.

Northwest Electric Light & Power Association—Accounting and Business Practice Section, Hotel Newhouse, Salt Lake City, Utah, May 22-23.

Edison Electric Institute—Joint meeting of Meter & Service Committee with Committee on Metering & Service Methods of the Association of Edison Illuminating Companies, Detroit-Leland Hotel, Detroit, May 26-28; Annual Meeting, Hotel Traymore, Atlantic City, June 2-5.

Pacific Coast Electrical Association—Annual Meeting, Mission Inn, Riverside, Calif., June 4-6.

American Society of Refrigerating Engineers—Spring Meeting, Hotel Alexandria, Los Angeles, June 9-11.

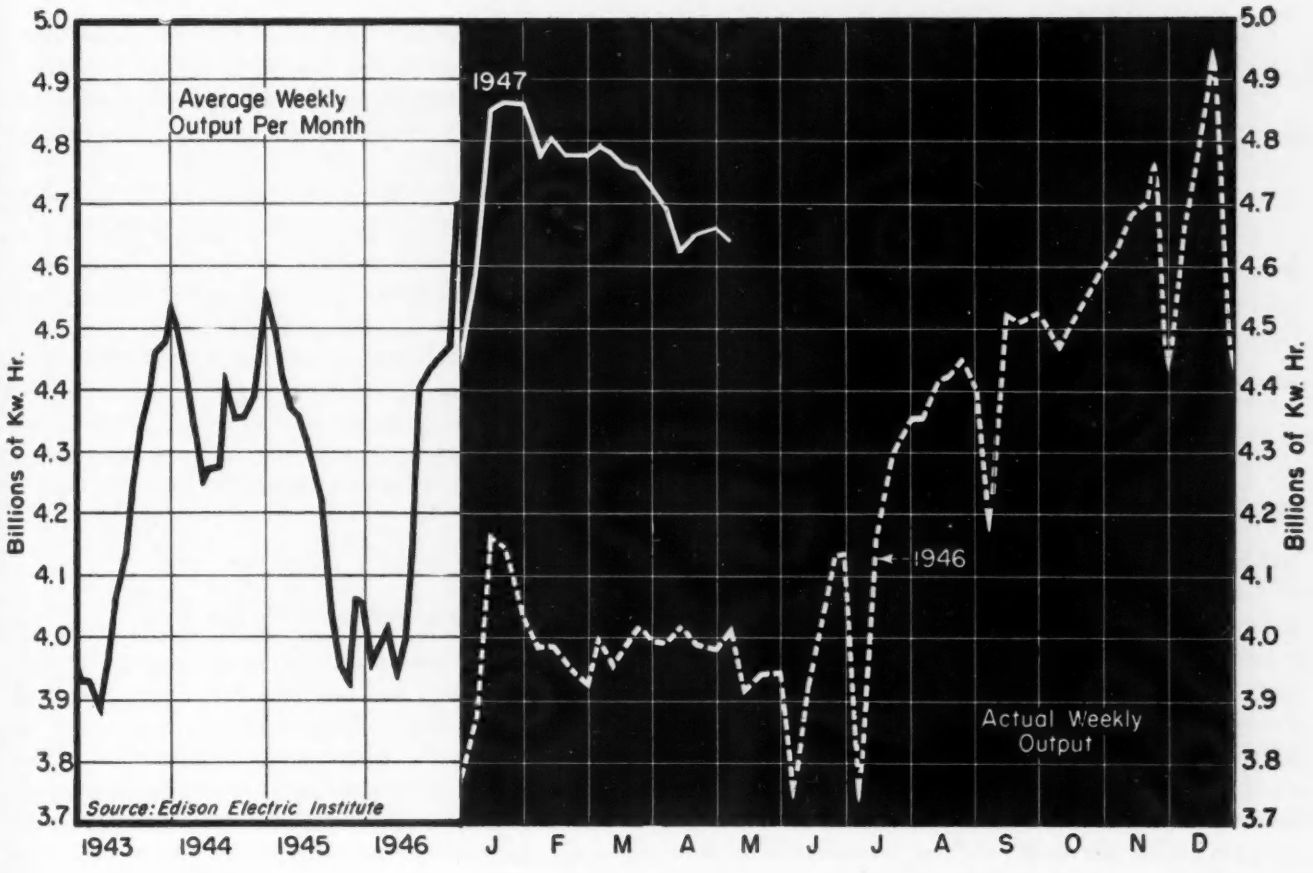
American Institute of Electrical Engineers—Summer General Meeting, Mount Royal Hotel, Montreal, Que., June 9-13; Pacific General Meeting, San Diego Hotel, San Diego, Calif., Aug. 26-29.

American Society of Mechanical Engineers—Semi-annual Meeting, Stevens Hotel, Chicago, June 15-19.

American Society for Testing Materials—Fiftieth Annual Meeting, Chalfonte-Haddon Hall, Atlantic City, June 16-20.

Public Utilities Advertising Association—Annual Convention, Book-Cadillac Hotel, Detroit, June 18-19.

Canadian Electrical Association—Annual Convention, Algonquin Hotel, St. Andrews, N. B., June 18-20.



NLRB Classifies Staff at Tidd Plant for Election

The National Labor Relations Board classified junior chemists and test engineers as professional employees and laboratory testers as technical employees in excluding them from a bargaining unit of operating personnel requested by the Utility Workers Union, C. I. O.

Involved is Ohio Power Co.'s Tidd plant near Brilliant, Ohio, one of the most highly automatic electric generating plants in the industry.

NLRB ordered a bargaining election, by May 17, among operating personnel, including control operators, stores attendants, and janitors. It excluded the junior chemists, junior test engineers and laboratory testers, which the union wanted included, as well as other categories which the union agreed to exclude. These were chemists, test engineers, guards, supervisors, and clerical, construction, probationary, and part-time employees.

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City Signs for Power

The Public Service Co. of Indiana has signed a contract with Logansport, Ind., to augment the output of its municipal plant with a permanent stand-by service of 10,000 kw. A 66-kv. line will be built from Kokomo to Logansport to provide the service. The Logansport plant has had a peak load of 7,200 kw.

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New Jersey Strengthens Recent Anti-Strike Law

The New Jersey Legislature has added new enforcement provisions to the state public utility anti-strike law.

One of the changes provides for Chancery Court injunction to prohibit any violation of the act. Under this section it would be possible to move against utilities refusing to enter into arbitration of differences after the state takes possession of a plant. It is likewise construed to open the way for restraint of picketing by strikers.

Arbitration boards are equipped with power of subpoena by another provision. Non-compliance would be subject to contempt action in the Supreme Court. The same court would hear appeals from arbitration board decisions.

Individual penalties are modified to affect only officers or agents of utilities or unions, who would be subject to fines of $25 to $250 a day under legislation of two weeks ago. The penalty of $10,000 a day against management or any union violating the act remains unchanged.

Output Turns Downward

The electric output curve moved downward during the week ended May 3, 1947, the first week of daylight saving, according to figures released by the Edison Electric Institute. The amount of electrical energy distributed by the light and power industry amounted to 4,640,371,000 kw.-hr., compared with 4,667,997,000 kw.-hr. during the preceding week. During the week ended May 4, 1946, the amount of electrical energy distributed totaled 4,011,670,000 kw.-hr., this year's figure representing an increase of 15.7 percent. The over-all increase last week was 17.4 percent.

Weekly Output, Millions Kw.-Hr.

1947		1946		1945	
May 3	4,640	May 4	4,012	May 5	4,397
Apr. 26	4,668	Apr. 27	3,977	Apr. 28	4,416
Apr. 19	4,660	Apr. 20	3,987	Apr. 21	4,411
Apr. 12	4,620	Apr. 13	4,015	Apr. 14	4,332
Apr. 5	4,693	Apr. 6	3,988	Apr. 7	4,322
Mar. 29	4,729	Mar. 30	3,992	Mar. 31	4,329
Mar. 22	4,759	Mar. 23	4,017	Mar. 24	4,402
Mar. 15	4,764	Mar. 16	3,988	Mar. 17	4,398
Mar. 8	4,787	Mar. 9	3,953	Mar. 10	4,446
Mar. 1	4,797	Mar. 2	4,000	Mar. 3	4,472
Feb. 22	4,778	Feb. 23	3,923	Feb. 24	4,471
Feb. 15	4,778	Feb. 16	3,949	Feb. 17	4,472

Percent Change from Previous Year

	May 3	Apr. 26	Apr. 19
New England	+10.2	+ 9.5	+10.3
Mid-Atlantic	+ 8.3	+10.8	+10.2
Central Industrial	+17.3	+19.1	+18.1
West Central	+17.5	+19.4	+18.1
Southern States	+18.3	+19.0	+18.4
Rocky Mountain	+18.0	+25.2	+22.2
Pacific Coast	+18.7	+20.2	+21.7
Total United States	+15.7	+17.4	+16.9

Electrical World
OPINION

Engineering Shortages

ANALYSIS of the present shortage of engineers, based on a report in this issue, leads to conclusions that are far from encouraging to engineering executives. It points to the need for attracting more young engineers into utility employment. It predicts that the present deficit in the industry will not be balanced before 1952.

This is a particularly unhappy situation because it falls in a period of record expansion of utility systems. While there is no way to avoid entirely the present shortage of engineers there are at least several policies that may ease the situation. Most obvious is the use of repetitive plans and standards to reduce the amount of engineering required.

More important are moves that take full advantage of engineering ability already available in an organization, such as the assignment of trained technical assistants to routine duties that in some present instances require half the time of engineers.

Contracting of engineering services on major construction will certainly increase in the future. With engineers at a premium, it has the advantage of reducing the year or two-year peak demand on layout and drafting, and permits more even flow of construction jobs.

It is unlikely that the shortages can be overcome in the next few years. Making the best and most efficient use of the supply available is, finally, the only solution. A review of duties, the uncovering of imagination and judgment potentials that may be obscured by seniority rules, and job training for semi-technical work appear to offer the best sources of additional engineering help.

"Can You Do It Better with Gas?"

ARE we electrical people overlooking a bet in the printing industry? Or do we admit that drying ink on freshly printed paper is a job electricity can't do so well?

These questions arise from talking with the operator of a large-edition printing plant—one with 30 or more big, high-speed presses. He says electric heat doesn't dry the ink fast enough, that it takes too long to reach the right temperature. This man has experimented with or has investigated electric heat in its orthodox forms of application to printing presses—infrared lamps, open and enclosed types of resistors. He says that it can't keep up with press speed.

He admitted that electric heat works nicely on many presses—ones that plug along comparatively slowly. The big fellows that pour out their production like a river in flood just have no time for electric heat. Also, electric heat, however applied, is mostly radiant, infrared. It goes through the ink and heats the paper underneath.

For these reasons, according to this authority, the open gas flame remains the best way known to dry ink fast. Do we electrical folks have to agree that, in this case, "You can do it better with gas?"

Repeal the Electricity Sales Tax

TAXES that are discriminatory, by chance or by unfair design, manifestly are unjust. The federal tax of 3⅛ percent on revenues from electricity sold to residential and commercial customers is discriminatory in these ways. Also, it is impossible of exact determination because of inherent difficulties in customer classification. Its contribution to government income, relatively, is very small. Its collection cost, compared with its yield, is very high. Its administration is not clear-cut and definite, but is cluttered with frequently contradictory orders and rulings applying to specific cases.

These are allegations in a report of the Taxation Accounting Committee of the Edison Electric Institue.

The law imposing this tax was enacted when anti-utility feeling was high and violent. The intent was at least partially punitive. Today, the unfairness and illogic of the tax are apparent. It should be repealed.

Discontent in the Southwest?

AFTER considerable negotiation, the Texas Power and Light Co. and the Southwestern Power Administration recently agreed upon a contract governing disposition of much of the power and energy available at SPA's Denison Dam. By present count, all three of the primarily interested parties are more or less discontent, even though each wanted a contract of one form or another.

Texas wanted and sought a contract, but it would have preferred a simple "buy-sell" agreement, without the concessions it had to make. SPA certainly wanted a contract, and in the late stages of the negotiations, made numerous concessions to get one. Yet an Interior official describes the contract as "difficult to sign" because it "gave so much away." The third party, the northern group of companies with which SPA will have to deal next, wanted a contract—made repeated offers to get one. Yet as written, the Texas-SPA agreement runs

counter to their concept—markedly so, on the record.

Two facts stand out, now that a contract has been reached. One is that the U. S. government has authorized or proposed about 28 more dams in SPA's territory. The other is that Interior Secretary J. A. Krug, according to recently released testimony, told the House Interior Appropriations subcommittee last January that the Denison contract will serve as a model for that area.

If either of these facts be realized, SPA and the companies will have to change their ideas or there will be considerable discontent in the Southwest.

Pattern for Power

TWO MONTHS after Congress received the Government Accounting Office's audit-report on the Tennessee Valley Authority, it has taken no action on it, nor, apparently even considered any seriously. This isn't particularly surprising, nor even serious. A number of issues are considerably more pressing, even much more serious. More important, Congress is engaged in a major political struggle. Its Republican masters are doing nothing without first considering what effect it might have on next year's Presidential election. Likewise, the Democratic opposition is concentrating solely on 1948. Right or wrong, this situation exists, and few Congressmen will permit anything so extraneous as good government to interfere.

Sometime, however, Congress is going to take a long, serious look at U. S. power policy. Sometime, it is going to do something about that policy. Then the TVA audit-report will be an important document. On one hand, it will be a potent weapon against the contention that a valley authority automatically creates a super state in its region—the allegation used so widely against the various Missouri Valley Authority bills. The audit-report praises TVA's management for having performed well the task assigned it. It found no super-state, just as the residents and governors of the TVA states found none.

Conversely, the audit-report will arm those who assail the almost-unqualified grants of power and the "blank-check" fiscal authority TVA has enjoyed. Disinterested auditors have reduced the "yardstick" to a pile of toothpicks. They have demonstrated the results of legislation so drawn as to be susceptible of unilateral interpretation. (In TVA's case, this effectively permitted an autonomous board largely to remove capital financing from the hands of Congress.) They have pointed out that no one ever can demonstrate whether such a venture is in fact paying its way in the absence of full and true cost accounting.

It is a pity that the audit-report, having cited demonstrable TVA weaknesses, did not complete the job by recommending that all, not just a few, of them be remedied. But even though it failed, doubtless for strategic reasons, to recommend payment of federal income taxes by TVA, the report noted such failure and stated its consequences. Congress can remedy this defect if it chooses.

WASHINGTON COMMENT

By R. N. LARKIN

IT has long been apparent that, eventually, a pretty serious effort would be made to overturn Section 5 of the Flood Control Act of December, 1944. This provision, of course, gives the Interior Department marketing jurisdiction over energy output of Army Dams.

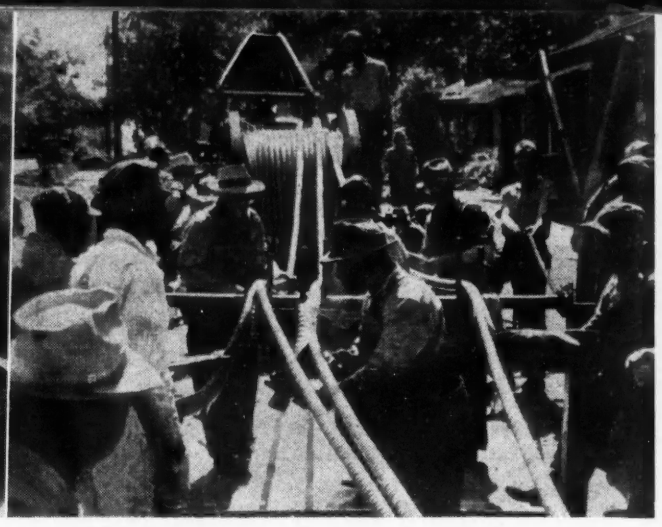
The first serious attempt came some weeks ago—with the introduction of the Dondero bill, which would let the War Department market its own power. Responsible Washington observers say that it could become law and that it will have powerful support within the Administration. It will need such support and a good deal more if the Dondero bill is to become law. Thus far, after four months of a new-broom Republican legislative body, there just hasn't been any reason to believe that Congress is finally ready to step right up to the issue of U. S. power policy and thrash out definitively the whole, involved, confused tangle it has become. When both houses reach a vote on the Dondero bill, the long-delayed but inevitable re-examination of U. S. power policy will be somewhere at hand.

It's considerably less difficult to punch holes in the Dondero bill than in the Thomas bill. Wisely, the Michigan Congressman has attempted less than the Oklahoma Senator. One unmistakable defect of the Dondero bill is that it permits the construction of necessary transmission lines for the integration of federal hydro plants without specific Congressional authorization. Another, common to all federal power legislation, is that it fails to spell out a repayment period for power investment. Neither is vital.

Most interesting is the bob-tailed version of the standard preferential sales clause, which directs that preference be given when, in the Federal Power Commission's opinion, it won't impair power sales. The possibilities in this approach are so broad that one hesitates to judge it. As mitigation of the un-American preference clause, it sounds fine. But it is hard to think of a more dangerous booby-trap for utility companies than this provision might become.

The bill's implications are striking. If it becomes law, the Southeastern Power Administration is out of business—but Texas Power & Light is bound by its recent contract. The "Southeastern Power Administration," long in gestation, will be aborted. The Bonneville Power Administration, apparently exempted, may get a jolt. The bill makes no change in the Bonneville Act, but the act gives BPA marketing authority only for Bonneville and Grand Coulee. It does not mention four other Columbia Basin projects which now are allocated to BPA only by Presidential order. BPA probably would end up marketing their power, but might have to bargain. Implications involving FPC are endless.

BOILING OUT joint preparatory to placing the sleeve over the joint, evacuating same and filling with oil



STRIPPING LEAD SHEATH from cable before entering pulling tube. End view

Five-Mile Oilostatic Cable Installation in Atlanta...II

R. O. LOOMIS • Special Engineer, Georgia Power Co., and
PAUL B. BOYD • Underground Distribution Engineer, Georgia Power Co.

THE BENNETT Oilostatic Transmission System* was installed in the sidewalk for approximately 70 percent of the 25,451 ft. between the Boulevard and Grady Distribution Substations. The placing of the cable system in the sidewalk along Boulevard was dictated by the City of Atlanta as, in part of the length, new street paving had recently been placed which could not be disturbed, and as the city did not have sufficient construction forces to repave the cuts made by us and to proceed with their normal street construction program as well. The line was placed in the streets only where no sidewalks existed, or where other utilities had already utilized the sidewalks. The placing of the line in the sidewalk was found to be generally easier and faster construction than in the street and seemingly no more objectional to the public than construction in the street.

Manholes Built First

Eighteen manholes were constructed in the line, the manholes being the first part of the system constructed. The construction of the manholes, as the first item of construction, allowed the cutting lengths for the cable to be determined before any pipe was installed. This allowed the cable manufacturer to manufacture the cable at his convenience. In a period of shortages of copper and lead it made a very satisfactory arrangement for both the manufacturer and the utility. The manholes were constructed of brick with concrete floor and roof slab. The inside dimensions of the manholes were 9½ ft. length, 5 ft. width, and 6½ ft. headroom.

Two manhole covers, one 33 in. diameter and one 24 in. diameter cover, were placed in the roof slab, located at extreme ends of the manhole roof. The manhole covers were placed directly over the pipe. The pipe was placed two ft. from one wall and a minimum of 2¼ ft. from the ceiling of the manhole to the top of the pipe. The manholes were located a minimum of 75 ft. from a street intersection, so no streets would be blocked during the pulling of the cables. The manholes were also located so they did not block places of business or driveways. The manhole roof slabs in the sidewalk areas were so located in respect to depth below grade that the street could later be widened without disturbing the roof slab. Since the manholes have been constructed Boulevard has been widened at two locations, effecting three manholes. Initially thirteen manholes were in the sidewalk, four in the street, and one in the substation yard.

Trencher Used

The pipe was installed below the water and gas service and below the majority of the sewer services. Minimum cover on the pipe was 3 ft.; average cover was 5 ft. It was originally planned to install the pipe with an average cover of 4 ft., but due to using a trenching machine which cut a maximum depth of 5½ ft. and due to having to place the pipe at greater depths at street crossings to pass under obstructions, the pipe was placed at the 5-foot depth. A trenching machine (Cleveland Model 95) was used for excavating for the entire length of the line except for street crossings. Due to the heavy traffic on cross streets, it was found more economical to tunnel most street

* See preceding instalment in Electrical World, April 26, 1947, page 42

crossings. The trench was excavated in all types of earth. Most of the excavation was in firm ground requiring no shoring. It was found by locating the water, gas, and sewer services previous to excavating with the trenching machine, relatively few services were damaged. These utility services were located from records, by locating meters or cutoff valves at curb, by use of an "M-scope", or by probing or by use of all methods.

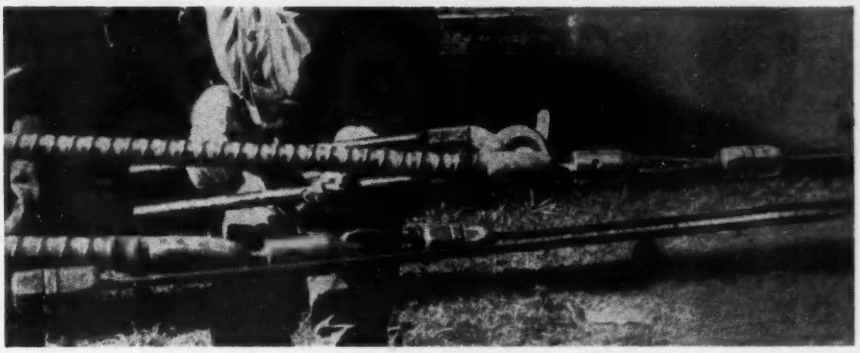
The pipe was cleaned thoroughly inside before being placed above the trench for weldings. The plugs were removed from the end of the pipe and a swab used to clean the inside of the pipe similarly to cleaning a gun barrel. After visual inspection to see the pipe was perfectly clean, the plugs were replaced, being finally removed just before two sections of pipe were welded together.

Coating Tested for Continuity

The Somastic coating was tested with the Holiday Detector for breaks in the coating. Any defects in the Somastic coating were repaired by heating the defective area with a torch and molding the coating with a putty knife, adding more Somastic compound to the area if necessary. The pipe was placed above the trench on 6 in. timbers covered with burlap bags filled with straw. The bags of straw distribute the weight of the pipe and prevent the Somastic coating being damaged. The pipe was aligned above the trench, placed so the welded seams in the pipe are on top and the chill rings were then placed in position.

Pipe Welding

Five to seven lengths of pipe were welded together above ground and the assembled section was pulled into the trench under the utility services. The pipe was electrically welded, the weld being made with three passes. Majority of the welds were position welds on which the first two passes were made with an $\frac{1}{8}$-in. rod and the third pass with a 5/32-in. rod. It was found very difficult to obtain a welder that qualified to position-weld pipe. Only two welders that could qualify were located during the installation of the pipe and they were obtained from pipe-line construction companies. All welds made during the course of one day were tested towards the end of the day.



THREE CABLES connected to 1-in. wire-pulling rope by special pulling eyebolt. Cables ready to pull into pipe

Welds were tested by jarring the pipe with a 2-pound hammer for a minimum of five seconds with the pipe under 100 psi. air pressure. With the line under pressure, the welds were checked by placing a collapsible water box around the weld. If any leaks are present, they will show up as bubbles. The air used for testing is dried before it was passed through the pipe, the air after passing through the dryer had a dew point under zero deg. F. This dry air was passed through the pipe for an hour or more previous to testing the welds and then was left in the pipe over night. Prior to starting work the following day, the dry air was released.

Bends Preformed

Bends in the pipe can be preformed before or after the pipe is welded into sections and then dropped into the trench. Bends of 40-ft. radius have been made before and after welding into sections. No damage was done to the Somastic coating in bending the pipe to short radiuses. Bends of long radius, 200 ft. or greater, can be made by pulling the pipe into the trench and making the trench form the pipe.

After the welds were tested, a pipe joint mold was placed around the pipe weld and filled with Somastic compound. The Somastic compound is furnished in form of chips which need only be heated, preventing having to weigh and mix the ingredients making up the compound in the field. The Somastic compound is heated in a special kettle having a double wall. Prolonged heating will burn the asphalt out of the Somastic compound requiring extra asphalt to be added. Whitewash is used to prevent the Somastic compound adhering to the mold surface.

As each section of pipe was installed in the ground, a No. 6 galvanized steel wire was pulled into the pipe. This wire is used to pull the one inch wire rope into the pipe which in turn is used to pull the cables into the pipe. Pipe lengths of 1,224 to 1,526 ft. are too long to rod using conventional duct rods.

After the pipe was installed, welds tested, and pipe joints covered with Somastic compound, four inches of dirt free from rocks was placed on top of the pipe. This earth was tamped lightly by having laborers walk over the backfill. A 3-in. thick protective pad of 1:3:6 dry mix concrete was poured over the backfill the full width of the trench.

The pipe was installed straight through the manholes to secure proper alignment through the manholes. After the pipe was extended fifty feet or more beyond a manhole, it was cut in the manhole using a pipe cutter. The completed section between two manholes was then capped, evacuated, checked for moisture during evacuation by using the G. E. trap immersed in dry ice and gasoline, and then filled with dry carbon dioxide gas under 5-pound positive pressure.

Reducers Installed

As the installation of the pipe proceeded, the installation of reducers (section reducing the joint to the diameter of the pipe) were started. The two reducers with tie rods in place were set up in the manhole and the two sections of pipe accurately aligned. Due to the pipe being extended through the manhole and then cut, very little re-alignment of the

CABLES leaving the manhole at the tractor end after being pulled through the pipe

pipes had to be made. Where some re-alignment had to be made, it was generally due to horizontal or vertical bends in the pipe adjacent to the manhole.

Re-alignment was made by heating the pipe. The reducers were welded to the pipe (butt weld) using either acetylene or electric welding. The pipe was cleaned thoroughly inside at the weld removing all icicles and rough spots. The weld was tested at 100 psi. air pressure using dry air. A plate was placed over the reducer, the section of pipe was evacuated and filled with dry carbon dioxide gas. This section of pipe was then ready to install cable therein.

Preceding by a day the day on which the cables were to be pulled into the pipe, the pulling tube and the special steel pulley over which the cables were pulled were placed in the manhole and the 1-in. wire-pulling rope was pulled into the pipe. The pipe was sealed on both ends with rags and Johns-Manville duct seal and carbon dioxide was allowed to trickle into the pipe from then until the cable was pulled into the pipe. All three cables were pulled into the pipe at the same time, carbon dioxide gas being allowed to trickle into the pipe during the period the cables were being pulled. The cables with the lead sheath removed were only exposed to the air for a matter of seconds as once the cables enter the pipe they are in atmosphere of dry carbon dioxide gas.

Stripping the Lead Sheath

A piano wire under the lead sheath was used to cut the lead sheath by a man on each length stationed adjacent to the reels. The lead sheath was then pulled away from the cable and cut off in 3- to 4-ft. sections by men adjacent to the pulling tube. The pulling stresses ran from 3,500 lb. to 5,500 lb. The maximum pulling stresses were obtained where there were 40 ft. radius 90 deg. bends.

After the cables were pulled into the pipe the micarta manifold was placed on the reducer, the cable ends were prepared by removing the D armor from the cable and covering the cable with V.C. tape and the night caps were placed on the end of the reducer sealing the cable from the atmosphere. The pipe and night caps were evacuated, tested for moisture, and filled with oil under 10-15 pounds positive pressure. Vacuum of 75-325 microns was applied to the pipe. The pipe was evacuated for 115 minutes (average) before oil was introduced into the pipe. The oil used to fill the pipe was Suniso No. 6 having a viscosity of 3,000 sec. at 20 C. and 260 sec. at 60 C. The vacuum pump was placed at the high elevation manhole of the section and the oil tank and pump at the low elevation manhole of the section. Vacuum was drawn on the pipe the entire time the oil was being pumped into the pipe.

Use of semi-stop joints made it possible to fill with oil each section of the line in which cable was installed the same day the cables were installed. Joints could then be made at a later date. The oil was shipped degasified and was handled under a closed system from the tank car to the pipe. The oil was always pumped into a tank or pipe which had been evacuated and the tanks always had nitrogen above the oil.

Joints and Potheads

Joints were made over a three-day period, 24 to 27 hours being required to complete the insulating and oil filling of a joint. At the end of each day the two halves of the joint sleeve were placed over the cables, the bolts tightened, and the joint flushed out and left filled with dry carbon dioxide gas over night. The joints could have been filled with oil each night but carbon dioxide gas was used as it was less messy. After completion of the joint, the joint sleeve was evacuated and filled with oil. There were nineteen joints in the system, two of which were terminating joints at the substation.

Each pothead was installed in an 8-hour day. Upon completion of all three potheads at each substation, the three potheads, riser pipes, and terminating joint were evacuated and filled as a unit. The evacuation was carried on over night, evacuating for eighteen hours or more to remove all moisture and carbon dioxide gas from the cable insulation, as the insulation had been in an atmosphere of carbon dioxide gas for several days.

Bypass and JJ-valves

Permanent by-passes around each joint were the last part of the installation installed. In each by-pass an automatic sectionalizing valve known as a JJ-valve was installed. The JJ-valve is designed and adjusted to open at some predetermined pressure or above and to close and stay closed at any pressure below this value. This prevents losing the oil in more than one section of the line due to a large break in the line. Some of the JJ-valves were set at 45 psi. and some at 75 psi. because of the large difference in elevation between either substation and the high point of the line (approx. 160 feet).

Two safety heads, one on either end of the joint, and a reservoir were installed in parallel with the by-pass on each joint. The diaphragm in the safety heads was set to rupture at 500 psi. If a short circuit should occur in the cable, which is extremely unlikely, the hydraulic surge would rupture the diaphragms on each side of the fault forcing oil into the normally dry reservoirs. A check of the reservoirs by removing the plug from the bottom of same would locate the two reservoirs containing oil, it could be assumed that the fault was located in the section between the two manholes containing these reservoirs.

The Bennett Oilostatic Transmission System was placed in service Aug. 21, 1946. Since the cable system has been placed in service, it has not been removed from service for any maintenance work on the system.

Neutral Grounding Limits Industrial System Faults

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Neutral grounding facilitates fault clearance and minimizes effects of transient over-voltages — Objectives of ground relaying — Maximum fault current determined by mechanical stresses in terminal apparatus — Burning in apparatus and cable during ground faults — Criteria for choice among four methods for grounding

ADVANCES IN THE design and application of fault clearing apparatus, such as relays and circuit breakers, has resulted in a trend toward the adoption of some form of neutral grounding for industrial electrical systems. Neutral grounding minimizes the number of the more disastrous phase-to-phase faults by making it possible to remove automatically ground faults before phase faults develop. It also eliminates the "cut-and-try" method of ground fault location that must be used on ungrounded systems. Transient voltages, caused by switching or ground faults, can be limited to 250 to 300 percent as compared to 500 to 600 percent experienced on ungrounded systems. A proper selection of the neutral grounding employed will result in an enjoyment of these advantages without excessive burning during ground faults, all of which adds up to less equipment damage and improved system operation.

To obtain the most satisfactory results with a grounded system, careful consideration should be given to transient overvoltages, ground relaying, mechanical stresses in terminal apparatus, and to burning during ground faults.

Transient Overvoltages

Field experience and theoretical studies have shown that arcing faults to ground on ungrounded systems can produce surge voltages as high as five or six times normal line-to-ground voltage.

A review of the typical insulation levels given in the accompanying Table I shows that this level of surge voltage may exceed the apparatus test voltage for all systems above 600 volts. The installation of a suitable grounding system will limit these surge voltages to 2½ to 3 times normal line-to-ground voltage, which is below the test level for all apparatus normally used on an industrial system. Proper grounding should consequently decrease the number of equipment failures attributed to surge voltages produced by switching or arcing grounds. Limiting these surge voltages is especially important on cable systems not exposed to lightning, because lightning arresters are not always used for apparatus protection on these systems. Furthermore, cable and pothead failures are more apt to give rise to high transient voltages than faults across insulators in open air.

TABLE I
Low-Frequency Test Voltages
(Voltages are expressed in number of times system line-to-neutral voltage)

System Voltage	Oil-Type Transformers	Dry-Type Transformers	Motors
600	28.8	11.5	6.1
2400	10.8	7.2	4.1
4160	7.9	5.0	3.7
4800	9.4	6.9	3.5
6900	6.5	4.8	3.6
13800	4.3	3.9	3.4

Ground Relaying

The grounding system should provide sufficient fault current during ground faults to obtain positive relay operation. Where ground relays are not used, the fault current must be high enough to operate phase relays. Ground relays, however, are recommended in all cases excepting possibly on low-reactance grounded systems where the ground fault current is usually at least 50 percent of the three-phase fault current. The use of ground relays does not necessarily mean a larger number of relays because it is entirely satisfactory to use one ground and two phase relays. It should also be mentioned that modern practice requires three tripping elements (three current transformers and three relays or three overcurrent trips) per three-phase circuit even on an ungrounded system. The former practice of using two tripping elements per circuit would be satisfactory providing the two tripping elements were installed in the same

* Adapted from a presentation before 1946 Midwest Power Conference, Chicago.

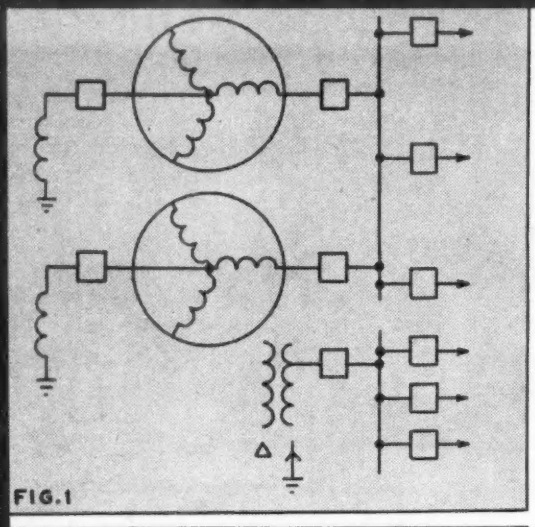


FIG. 1

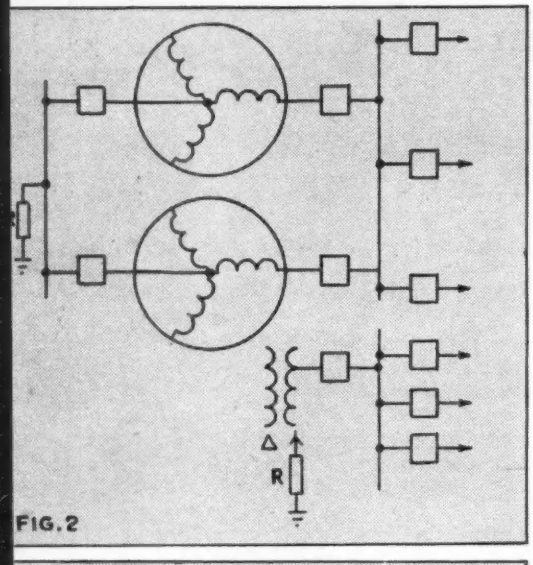


FIG. 2

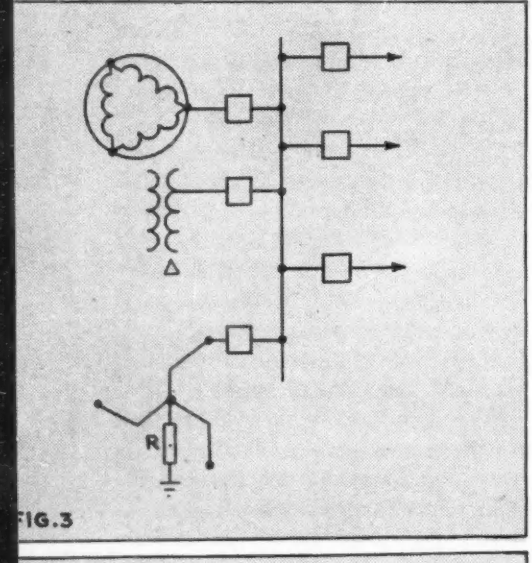


FIG. 3

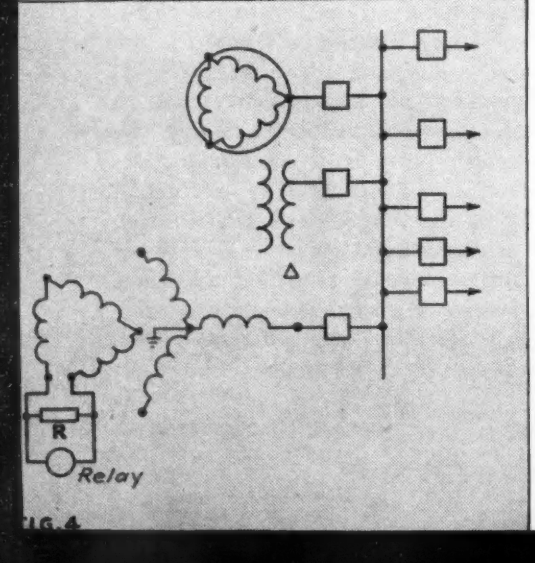


FIG. 4

phases in all circuits, which frequently is not the case. If the two tripping elements are not in the same phases in all circuits, certain types of simultaneous faults to ground will not be relayed. For example, assume a phase A to ground fault on circuit No. 1 and a phase B to ground fault on circuit No. 2. If the tripping elements are installed in phases B and C in circuit No. 1 and A and C in circuit No. 2, no element will receive fault current and tripping will not take place. Consequently, phase-to-phase fault current is allowed to flow until the fault is cleared manually or until backup deenergizes the entire system. The possibility of this kind of trouble has shown the need for using three tripping elements per circuit even on ungrounded systems.

Where ground relays are used, positive relay operation can be obtained with a ground current considerably below load current. However, when the ground current is limited to too low a value, it is often necessary to use very sensitive relays and to check carefully the saturation characteristics of current transformers. For these reasons, it is recommended that the ground current be at least as high as rated current in the largest circuit, which is usually a generator or a supply power transformer.

The installation of a satisfactory ground relaying system will allow immediate isolation of all ground faults with a minimum amount of disturbance to the system. This is in contrast to the location of ground faults on ungrounded systems by switching out circuits one at a time until the fault is removed. This practice is not too satisfactory on an extensive system, especially if two circuits are faulted to ground at the same time. In the latter case it may be necessary to shut the system down and then return circuits to service one at a time to locate the trouble.

FIG. 1—Reactance Grounding—Power transformers can be grounded solidly whereas neutral reactors are required to limit short-circuit stresses in generators

FIG. 2—Low-Resistance Grounding — Neutral resistors should be used where it is desired to limit the ground-fault current below 60 percent of the three-phase fault current

FIG. 3—Combination Grounding—A zigzag transformer furnishes the neutral for resistance grounding in delta systems

FIG. 4—High-Resistance Grounding—Where ground relaying is not to be used, a high-resistance ground limits voltage-to-neutral to safe values. Here although the primary neutral is solidly grounded, an inexpensive high resistance in the broken delta secondary acts as a ground resistance by choking circulating currents caused by ground faults

Maximum Ground Fault Current

The maximum fault current that should be allowed to flow during single-line-to-ground faults is determined by the permissible mechanical stresses and burning in apparatus and cable. Generators are braced for the mechanical stresses produced by three-phase short circuits so the fault current in these machines should never exceed the three-phase fault current. This usually requires that generators be operated ungrounded or grounded through a current-limiting impedance. Motors are practically always operated ungrounded so their mechanical stresses during system faults is not a factor in choosing system grounding.

The amount of burning during ground faults in cables, generators, motors, etc., has often been the criterion in fixing the maximum ground fault current. An upper limit to burning can be calculated by assuming that the fault resistance is equal to the source impedance, since this condition results in the maximum possible dissipation of heat in the fault. This procedure will be conservative, especially when the fault current is large. It is questionable whether this method should be used, even as a guide, when the ground fault current exceeds a few thousand amperes, or when long fault-clearing times are involved. The method, however, has some merit in comparing grounding systems in which the ground current is limited to a few thousand amperes. The typical examples in Table II will illustrate the method. In the first example, a 6,900-volt system is grounded through a two-ohm resistor and maximum heat dissipation in the fault is obtained when the fault resistance is equal to the source resistance, or equal to two ohms. With the fault resistance equal to two ohms, the current is limited to 1,000 amperes and the fault power to 2,000 kilowatts. Assuming a 0.15-second fault-clearing time (one-cycle relay time and 8-cycles breaker time

on a 60-cycle basis), the energy dissipated in the fault is 300 kw.-sec. As approximately 4,000 kw.-sec. are required to vaporize one pound of either copper or iron, starting with an initial temperature of 75 degrees C., a maximum of only 0.075 lb. of metal can be vaporized for the assumed conditions.

Grounding Systems

Reactance grounding, such as illustrated on the generators in Fig. 1, will limit the surge voltage due to either switching or faults, if the grounding reactance is not too large. In such applications, the single-line-to-ground fault current should not be limited to below 60 percent of the three-phase fault current. The single-line-to-ground fault current will be sufficiently large under these conditions to obtain very satisfactory relaying of ground faults. Wye-connected power transformers can always be solidly grounded without being concerned about mechanical stresses in the windings during ground faults. Generators, however, will usually require some neutral impedance to limit the ground fault current in the windings to a value equal to the current the generator can deliver to a three-phase fault at its terminals.

Where it is desired to limit the ground current, it is recommended that the generator or transformer neutrals be grounded through resistors as shown in Fig. 2. Usually only one generator on a common bus is grounded at one time in order to limit circulating currents between machines, although this caution is not always necessary. The resistors are usually chosen to give ground currents equal to or higher than the rated current of the largest circuit in order to obtain satisfactory relaying.

Grounding transformers are often used when the generators or power transformers are not wye-connected. However, these transformers are usually small in comparison to the power sources, so are equivalent to a high reactance ground. Systems so grounded are, therefore, subject to high transient voltages. This grounding, however, is superior to ungrounded operation because ground faults are automatically cleared, and the probability of trouble from arcing grounds is decreased. Surge voltages due to arcing grounds can be minimized by connecting the neutral of the grounding transformer to ground through a resistor. To be effective, the resistance of the resistor should be at least twice the reactance of the transformer.

In applications where it is definitely decided not to relay ground faults, a special type of resistance grounding is recommended. In these cases, the system should be grounded through an effective resistance equal to, or some less than the 60-cycle capacitive reactance between the three phases and ground. This grounding will limit surge voltages due to arcing grounds and some switching operations, so will result in considerable improvement over ungrounded operation. The ground fault current will not increase more than 50 percent to 100 percent, which means that the burning due to ground faults will not increase so very much. Of course, ground fault selectivity is not possible with this scheme.

In applying the latter grounding, the single-line-to-ground fault current of the ungrounded system is measured or calculated. The product of this current and the system line-to-neutral voltage in kilovolts will give the kilowatt rating of the required resistor. The resistor is connected to the system through a wye-delta transformer bank as illustrated in Fig. 4, in order to eliminate the resistor losses excepting during ground faults. It should be noted that the line-to-neutral rating of the high-voltage side of the transformers should be as high as the system line-to-line voltage to prevent saturation during ground faults. The current rating of the transformer windings should be sufficient to carry the resistor load. A voltage relay across the resistor can operate an alarm in case of a ground fault.

General Recommendations

1. Some type of grounding should be considered in order to obtain the advantages of fast clearing of ground faults and to minimize the effects of transient overvoltages.

2. The grounding system selected should provide sufficient ground fault current for positive relay operation, which usually dictates currents at least as large as the rated current of the largest circuit, including generators and power transformers.

3. Where reactance grounding is used, the single-line-to-ground fault current should be equal to or higher than 60 percent of the three-phase fault current in order to limit transient overvoltages.

4. Resistance grounding should be used whenever the ground fault current is limited to below 60 percent of the three-phase fault current.

5. Grounding transformers should be grounded through neutral resistors to be effective in limiting transient overvoltages. The resistor impedance should be at least twice the transformer reactance.

6. In those applications where it is decided not to relay ground faults, high resistance grounding should be used to control the transient voltages due to arcing grounds.

TABLE II
Maximum Fault Damage
(System voltage—6,900 volts)

Grounding	Fault Power, kw.	Clearing Time, sec.	Fault Energy, kw.-sec.	Metal Vaporized, lb.
2-ohm resistor	2000	0.15	300	0.075
		0.30	600	0.150
		1.00	2000	0.500
4-ohm resistor	1000	0.15	150	0.038
		0.30	300	0.075
		1.00	1000	0.250
2-ohm reactor	1000	0.15	150	0.038
		0.30	300	0.075
		1.00	1000	0.250

* Based on 4,000 kilowatt-seconds per pound of either copper or iron.

HELP WANTED

Young Engineers Needed

FRANK E. SANFORD
Western Editor

ELECTRIC UTILITIES must employ three times the number of young engineers in the next 15 years that they have employed in the past 15 years, if they are to maintain their present engineering personnel. The present shortage of engineers can be expected to become much more serious before it is relieved. The supply, even when the present record enrollments become available as graduates, will fall far short of meeting the demands.

The present shortage of engineers is well known. But that it is due to become worse before the supply can even begin to meet the need is not commonly understood. Nor is it generally realized that the situation within the ranks of younger men—the experienced engineers of the next decade—can become critical for the power industry. One contributing factor, reported by those seeking to employ graduates, is a lack of interest in power engineering, compared to the glamor of electronics. Beginning salaries, too, have often not been attractive enough in such a competitive situation. Moreover, lack of challenge or opportunity in a "stabilized" industry is a common conviction of many students.

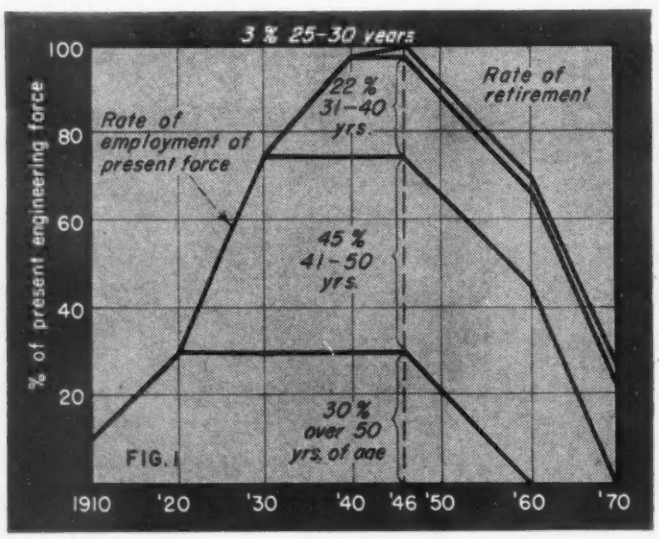
This report is based on information from a representative group of companies employing from 25 to 800 engineers. Data on the supply of graduate engineers has been obtained from the American Society for Engineering Education. A general impression of the employment situation was derived from discussions with engineering executives and personnel directors, including several who have interviewed prospective engineers among senior students. Discussions with several groups of students, and individuals, have further contributed to the conclusions derived from the analysis of statistics.

Long Range View

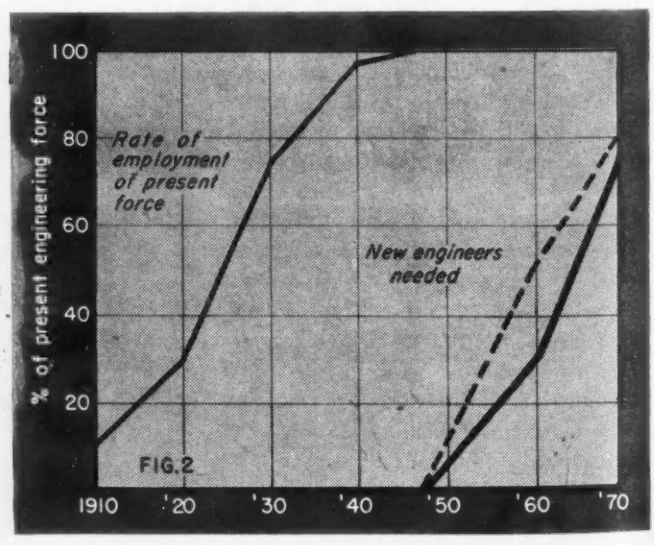
For the long-range view of utility engineering requirements, the accompanying chart (Fig. 1) based on analysis of present ages of engineers now employed, will serve as a starting point. Variations in the individual company data were small, within about 5 percent on the major points. The figures used are averages.

About 30 percent of the engineering employees are 50 or older, and 45 percent are between 41 and 50 years old. The drop in employment during the decade 1930-40 is reflected in the size of the present 31- to 40-year age group of about 20 to 25 percent of engineers. The percentage

RETIREMENTS by 1960 of 30 percent of present engineering forces will accelerate in the ten years following because 45 percent of men now working started in the ten years following 1920. Normal retirement expectancy, shown, must be increased to allow for attrition due to other causes



NEW ENGINEERS needed each year in the utility field will equal or exceed the numbers of 1920-30. Losses due to other causes before age 65 are estimated in the dashed line, but no allowance is made in this estimate for overcoming the present shortage in engineering forces



under 30 years of age varied from zero to 5 percent among the companies. A general pattern of the employment year is shown by projection from the 1946 line.

Many engineers past the age of 65 have deferred retirement, but the mounting list in the past two years emphasizes the point that most of the men now over 50 will be retired by 1960. By 1970, most of the men now over 40 will be retired, removing 75 percent of the present engineers.

That may seem a long way off. Transferring the number of replacements required to another chart (Fig. 2) defines the problems more clearly, however. For straight line replacement at age 65, the solid line shows the number of new recruits needed to maintain present engineering personnel. Attrition due to earlier retirement, transfers from engineering and actuarial statistics are estimated in the dashed line.

It is interesting to note that this line parallels the employment rate of the 1920-30 decade. Between now and 1960, there must be added to the engineering staffs 50 men for every 100 now employed. This is probably a conservative estimate, if trained men are to be available to meet the increasing rate of retirement after 1960.

Engineering College Survey

A study made by an A.S.E.E. committee a year ago and reported in the *Journal of Engineering Education* (September, 1946) puts figures on the situation of demand and supply of engineering graduates that are daily becoming more apparent. The deficit of engineers in all branches is now more than 25,000. A carefully prepared projection table shows that annual needs and annual cumulative deficits in engineering personnel will reach a deficit peak of 37,800 in 1949. Not until 1952 will the deficit be wiped out. Figs. 3 and 4 are based on their data.

The area under the estimated section of the curve showing first degrees granted is just about sufficient to offset the loss during the war years and bring the average back on the trend line. It is evident that the college laboratories will be stressed to, or beyond, capacity when the present record enrollments reach the upper class years, but an over-supply of graduates is not apparent from this curve.

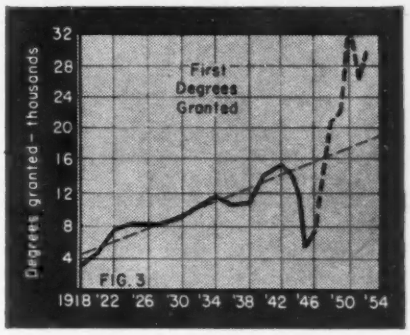
For the demand side, the committee surveyed 125 industrial companies and their summary data are shown on Fig. 4. The need a year ago was more than the annual employment before the war. The expected future need during the next few years is twice the employment rate before the war. Another interesting observation is the much greater requirement for engineers with advanced degrees for development and research. Barring a major national economic collapse, any idea of a surplus of engineers in the next few years would seem to be fallacious.

Employing the Graduates

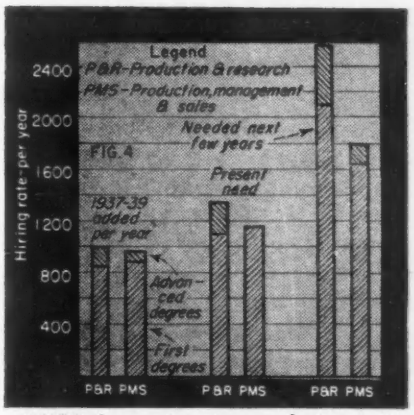
Many utility companies are now actively seeking graduating students for employment. One personnel director, seeking 15 men, had none signed after interviews in three colleges. Another was more fortunate, obtaining two applications from eleven interviews in a neighboring college. Another had five preliminary applications with expected starting salaries 30 percent higher than they were prepared to offer.

Starting salaries offered have been increased about 50 percent compared to pre-war. The A.S.E.E. survey among all branches of engineering showed $145 as an average in 1939 and $210 in 1946. Among the electric utilities recently interviewed, $200 per month is most frequently mentioned, and $50 per week is the average reported by 20 companies including some industrials. Salaries expected by the students are averaging from $225 to $275 per month and offers of less than $200 are attracting very few applications. A starting salary of $240 by one company is not meeting with any rush of applicants. Discussions of security, pensions, etc., create very little interest at this point.

From the viewpoint of the young men approaching graduation, starting salaries are of much greater relative importance than they were in normal years. In one group of students attending an A.I.E.E. section meeting, more than one-third were married. In a senior class group, one-half were married. Many students feel the pressure of "lost" years in their careers.



THE "FLOOD" of engineering graduates during the next few years, caused by the war disruption of education, averages out only to the normal trend and will not create a surplus. Peaks ahead are probably above the capacity and will tend to reduce



NEEDS for engineering graduates, estimated by 125 industrial companies, call for double the hiring rate of the average during three years before the war. Estimated for advanced degrees in development and research are four times as great as previously and double in production, management and sales

They are, in the unanimous opinion of the professors, the most serious students ever enrolled and drop-outs are at an unusually low level.

Electronics is a serious competitor of power for the interest of the E.E. students. Several professors report that the ratio of electronics to power in theses and elective subjects is about four or five to one.

How It Adds Up

In the final analysis electrical engineering as applied to 60 cycles must be sold to the graduates who can gradually fill in the deficit of supply. The glamor of such things as radar tends to upset the normal flow into the older channels. An industrial race in newer fields of application will add emphasis to the need for keeping power young and progressive in its interest.

Determination of Required

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Planning and Development Dept.
Duquesne Light Co., Pittsburgh

ON AN ELECTRIC power system the generating stations account for a rather large percentage of the total system investment, and the determination of the proper amount of spare capacity is a very important problem involving millions of dollars. The proper solution is presumably the correct balance between cost of service and the reliability of service to the customer, taking into account the fact that the power stations are only one factor contributing to the total of all customers' interruptions. The primary purpose of this paper is to suggest a method for determining the proper amount of generator reserve based upon a definite criterion of customer service continuity. The numerical results contained herein should not be taken as the final answer for individual companies. Furthermore, the numerical results depend upon many factors such as seasonal variation in peak loads and may be expected to change in the future.

Interconnections Economize Reserves

Before the advent of interconnection, each company had to stand on its own feet and provide adequate reserve in its own stations. The minimum requirement presumably would be the ability to take a large unit out of service for maintenance and still be able to carry the load if another unit should break down. This requirement in general, would result in a reserve of 20 to 30 percent of the installed generating capacity.

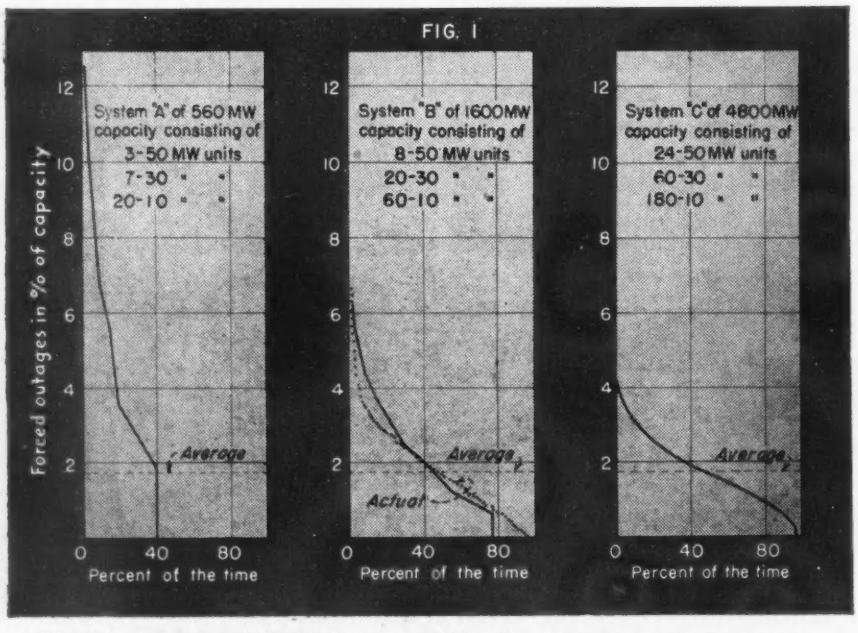
As reliable interconnections came into being, it was recognized that the amount of reserve generating capacity on each system could be reduced somewhat. Some rather simple probability calculations, as well as operating experience, showed that as the size of the interconnected system increased, the probability of any given number of kw being out of service increased, but the probability of having any given percentage of the total capacity forced out of service progressively decreased. The maintenance of large units could also be coordinated in order not to have an undue amount of capacity out of service at any one time.

Since most systems have workable interconnections and operate in parallel with several other companies, a means must be devised for evaluating the interconnection capacity in order to determine the reserve required on each individual system. The capacity of the tie lines themselves does not furnish a complete answer to this question, since it is necessary for each company to provide its share of the total reserve in the region. This problem has been carefully studied by engineers in many companies and some of the data published by the E.E.I. power generation committee is of great value in this respect.

Tie-line Effectiveness

The Duquesne Light Company has been conducting studies to establish a rational method of evaluating the effectiveness of the tie lines and determining the required reserve on the basis of its effect on customer service continuity. As an illustration of the various principles involved, three hypothetical systems were analyzed as shown on Fig. 1. System A, with a capacity of 560 mw. is supposed to

FIG. 1


Forced outages in % of capacity
System "A" of 560 MW capacity consisting of 3-50 MW units
7-30 " "
20-10 " "
Average
System "B" of 1600MW capacity consisting of 8-50 MW units
20-30 " "
60-10 " "
Average
Actual
System "C" of 4800MW capacity consisting of 24-50 MW units
60-30 " "
180-10 " "
Average
0 40 80
Percent of the time

EFFECT OF INTERCONNECTION on probability of generating capacity forced outages. System B is equivalent to three companies similar to System A; System C is equivalent to nine companies similar to System A. Solid curves show the calculated most probable amount of capacity outages for various periods. Dotted curve shown with system B is actual forced outage performance of 1,600 mw. of interconnected capacity in Western Pennsylvania—January—August, 1944. Forced outage time in all studies assumed to average 1.75 percent, based on actual experience in Western Pennsylvania.

* Adapted from recent paper presented before joint meeting of the hydraulic power, prime movers and systems operations committee of the Pennsylvania Electric Association.

Reserve Generation Capacity

Suggests method based on specific criterion of customer service continuity

correspond roughly to a single company. System B is intended to correspond to the interconnection of three companies having a total capacity of 1600 mw. System C is three times as large as system B and might represent a regional interconnected system.

Probability of Outage

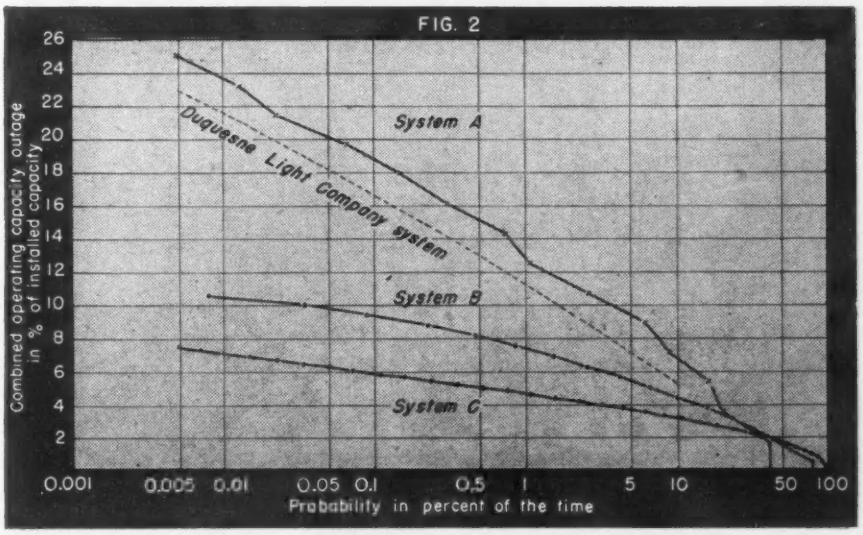
Using outage probabilities based upon experience, the probability of various capacity outages has been calculated and shown on the diagram. The average capacity outage is the same in all three cases, but it is evident that as the size of the system increases, the maximum outage (in percent) declines. It should be noted, however, that the capacity saving, resulting from interconnection, follows the law of diminishing returns as the size of the interconnection increases. A further increase in size, above that of system C, would add only a relatively small amount to the gain through diversity of unit outages. It can be shown that an interconnected system of the size of system C, realizes 80 or 90 percent of the total inherent saving. This relationship has been demonstrated by actual operating results on large interconnected systems. The dotted curve shows the actual record from an interconnected group of about the size of the hypothetical system B. This verifies, in a general way, the reasonableness of the calculations. This correspondence between theory and experience has been very well demonstrated by some of the work of H. C. Forbes as presented in E.E.I. reports on generator outages.

The three hypothetical curves are shown again on Fig. 2 using a logarithmic scale so that capacity outages with probabilities down to 0.01 percent can be recorded.

Correlation Found Good

Probability of various capacity outages on the Duquesne Light system was calculated using the actual unit sizes and the results are very close to the hypothetical system A and are shown by the dotted curve on Fig. 2. The seasonal variation in plant ratings and in system peaks, as well as the scheduled maintenance program, were taken into account as shown on Fig. 3. The maintenance program was based upon two weeks per unit per year. This is about 4 percent of the time and is quite close to actual past experience. The chart shows that the summer is the most critical period since the maintenance outages occur at that time. The summer decrease in load is still somewhat greater than the decrease in station rating so the summer is still the best time to perform maintenance on large units. However, the trend toward more summer load, such as air conditioning, must be carefully watched and there is a possibility that in the future the winter may be

FIG. 2

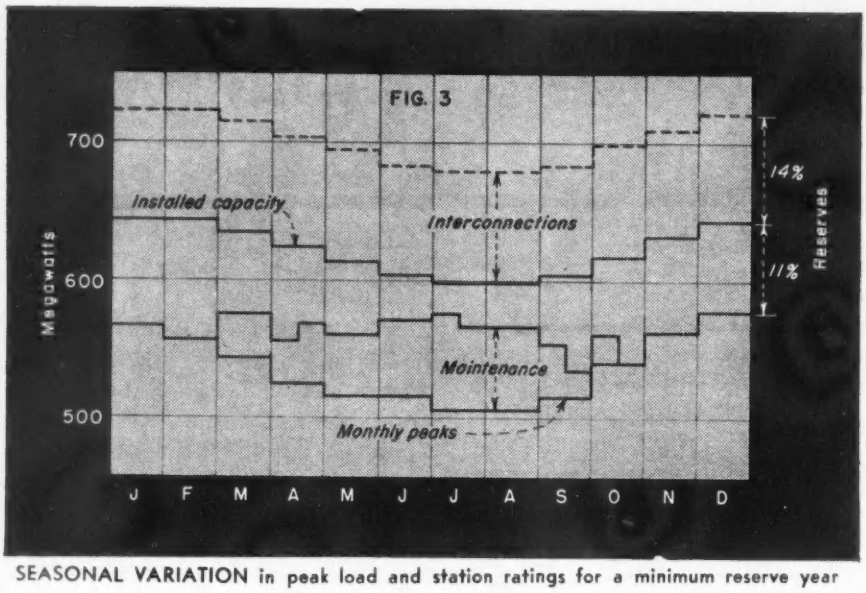


PROBABILITY of generating capacity forced outages for 3 hypothetical systems:

System A Units	System B Units	System C Units
3-50 MW	8-50 MW	24-50 MW
7-30 MW	20-30 MW	60-30 MW
20-10 MW	60-10 MW	180-10 MW
Total 560 MW	Total 1600 MW	Total 4800 MW

Assumed average probability of individual machine outage: 1¾% of time

For example—in System B, the probability of a 10% or greater capacity outage is 0.03%. Assuming 15 hours per day, 5 days per week (= 3,900 hours per year) heavy load period, this means an average of 1.17 hours per year that this condition would exist. The probability of a 10% or greater outage on system A is about 100 times as great as on System B



SEASONAL VARIATION in peak load and station ratings for a minimum reserve year

a suitable time to perform some of the maintenance on the generating equipment.

Fig. 3 shows the average reserve each month of the year at the time of the monthly peak. Monthly load duration curves were used to show the reserve by hours during the peak load periods and this was combined with the probabilities from Fig. 2 in order to get the combined annual probability of a capacity shortage caused by a forced outage of one or more generators or boilers.

Forced Outage Probability

Fig. 4 illustrates in a general way, how this computation was made for the month of July during which the breakdown reserve reached its lowest value. The probability of various values of forced outage must be combined with the corresponding probability that the system load will exceed the remaining available capacity at the time the combined breakdowns occur. Fig. 4 shows that for forced outages totaling between 140 and 160 mw. (150 mw. average), the remaining capacity, taking into account the maintenance outage of 66 mw. is 41 mw. less than the monthly peak. The load is above this value for a total of 100 hours during the month. Combining these figures, it can be seen that the average customer interruption time for this particular month and for capacity outages between 140 and 160 mw. would be 0.0168 minutes per customer. Smaller values of forced outage are more probable but have less chance of dropping load, whereas the larger outages would affect more load but are much less probable. A summation of the effect of all possible forced outage combinations gives a total average interruption time of 0.045 minutes per customer.

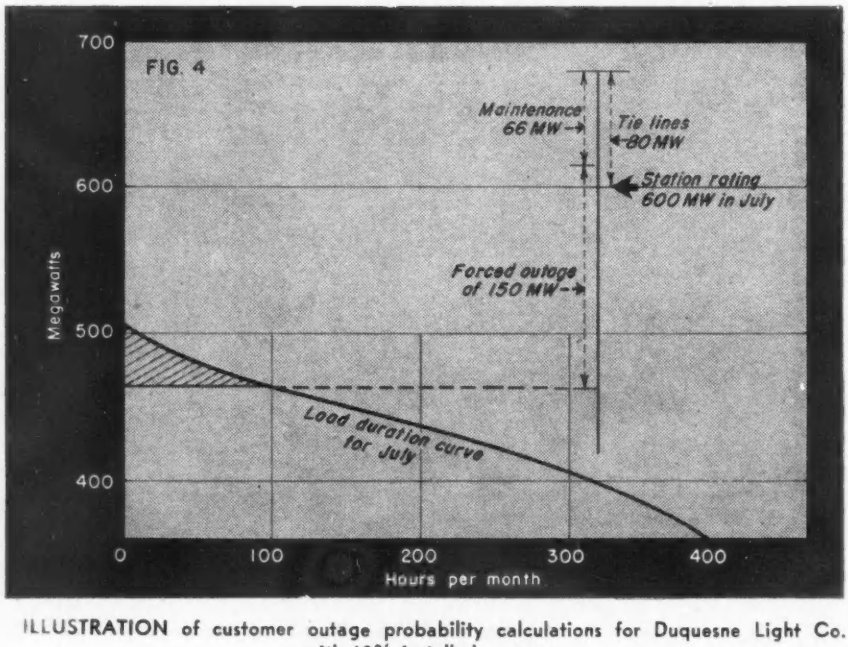


ILLUSTRATION of customer outage probability calculations for Duquesne Light Co. with 10% installed reserve.

Probability of 150 ± 10 MW outage = 0.00007
Length of time load is above 465 MW = 100 hr. or 6,000 min.
Average amount of load dropped = 20 MW
Part of system load dropped = $\frac{20}{505}$ = 0.04

Average minutes interruption per customer (0.00007) (6000) (0.04) = 0.0168 min.
Total probability for all magnitudes of forced outages = 0.045 min. per customer

0.15 Minutes Per Year Per Customer

The summation of similar calculations for other months is shown on Fig. 5, illustrating the probable average interruption time in minutes per customer per year which may be expected for any given amount of reserve capacity including the effective emergency capacity of the tie lines. This chart shows that with an over-all reserve of 145 mw. the customers could be expected to average about 0.15 minutes per year interruption time as a result of generating station capacity shortages.

It is obvious that there is considerable room for the exercise of judgment in selecting a reserve capacity figure on the basis of service continuity. One method of approach, however, would be to consider that from a practical standpoint a capacity shortage would probably cause the dropping of not over 10 percent of the system load. This 10 percent would very likely be principally the large industrial customers. On an average these customers have an interruption time from all causes of about 15 minutes per year. If we assume that it would be reasonable for 10 percent of this time to be caused by generating capacity shortages, this would mean

an average of 1.5 minutes per customer per year. However, since only 10 percent of the load would receive all of the interruption time, this would correspond to a system average of 0.15 minutes per year. Referring to the chart, this means a total reserve of 145 mw including the interconnections. The problem still remains as to how much of this 145 mw. should be installed reserve and how much should be tie-line capacity.

Tie-lines vs. Reserves

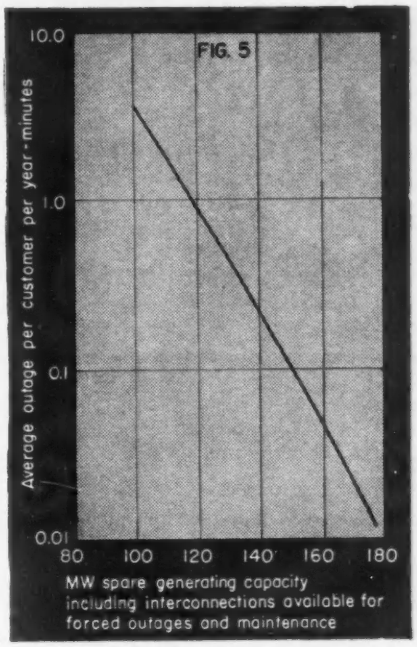
This problem was approached by dividing the reserve into maintenance and forced outage components. Maintenance requires an average of 4 percent of the capacity and on the Duquesne Light system this would be about 26 mw. This would mean that 145 minus 26, or 119 mw. would be available for breakdown. Referring to the dotted curve on Fig. 2, we find that at 119 mw. outage (18.5% of the capacity) has a probability of 0.05 percent. One method of visualizing this probability is to assume that there are roughly 4,000 heavy load period hours during the year in which case the probability of 0.05 percent means two hours per year. In view of the fact that during most of the 4,000 hours the load is considerably below the monthly peaks, it is obvious that the two hour probability is not a serious threat to service continuity.

Referring to system C on Fig. 2, we find that a probability of 0.05 percent corresponds to a capacity outage of 6.3 percent. Thus, for a large interconnected system, a reserve of 6.3 percent for forced outages plus 4 percent for maintenance, or a total of 10.3 percent appears to be adequate.

If this conclusion seems at all reasonable, then a general pattern for installed reserve and interconnection capacity is indicated. Thus, if each company were to maintain a minimum installed reserve of about 10 percent of the total capacity, it would be carrying its proportional share of the regional reserve. If the company were of a size approximately the same as the hypothetical system A, it would require a total reserve of about 20 percent (Fig. 2) in order to meet the forced outage requirement of 0.05 percent probability plus 4 percent for maintenance or a total of 24 percent of the installed capacity. If the company maintained an installed reserve of 10 percent, then the interconnections would have to be good for the difference between 24 percent and 10 percent, or 14 percent of the system capacity. If the interconnection capacity were less than 14 percent, then the installed reserve would have to be greater than 10 percent. However, if the interconnection capacity were more than 14 percent, the installed reserve could not be reduced below 10 percent since this is the minimum responsibility for each company in the region.

Self-sustaining Aspects

As a company, or interconnected group of companies, increases in size, it becomes more self-sustaining and its requirements for interconnection capacity to outside companies progressively decreases. This can be illustrated by the three hypothetical companies as follows:



TOTAL RESERVE on winter peak, including both installed generating capacity and interconnection capacity, needed to provide for both maintenance and forced outages vs. probable average interruption time in minutes per customer per year—due to power station capacity shortages

System	*MW*		
	A	*B*	*C*
Installed Capacity	560	1600	4800
Maintenance requirement (4%)	22	64	192
Breakdown reserve (for outage probability of 0.05%)	112 (20%)	157 (9.8%)	302 (6.3%)
Total reserve requirement	134	221	494
Installed Reserve (10%)	56	160	480
Tie Line Requirement	78 (14%)	61 (3.8%)	14 (.3%)

Although a reserve requirement of 10 percent of the installed capacity (11 percent of the peak load) is smaller than the amounts which have generally been used in the past and may at first glance appear to be inadequate, it must be considered in the light of the following:

1. A 10 percent minimum installed reserve requirement means that theoretically it is only in the year before a new unit is added to the system that the 10 percent minimum is approached. In all other years the spare capacity would be greater and thus would average probably from 12 to 15 percent. Since all companies do not install new capacity at the same time, the total reserve on a regional basis would always be over 10 percent.

2. During the past 15 or 20 years, there have been no customer interruptions on the Duquesne Light system caused by an inadequate amount of installed capacity. During this period the reserve ranged all the way from 45 percent during the depression down to less than 10 percent during some of the war years.

3. Station ratings are usually established such that under normal conditions there is a small margin of capacity available. This is more likely during a capacity outage.

Emphasis should be placed upon the method proposed in this paper rather than upon the numerical results which, in this case, turned out to be an installed reserve of 10 percent. Individual companies using this same method might obtain different results depending upon the available tie line capacity, service reliability requirements and other local conditions.

Today's Mercury Lamp For Street Lighting

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SINCE THE mercury-vapor lamp was first used commercially for street lighting in this country about ten years ago, improvements in lamp construction, operation and allied circuit equipment have gained for it a place of increasing importance.

About 100 to 150 installations are now in operation, and utility and municipal officials throughout the country are showing a widespread interest in them. Many of these officials are visiting such outstanding mercury street lighting installations as those at Denver, Colo., as well as the demonstrations set up by leading manufacturers of street lighting equipment.

While incandescent lamps undoubtedly will predominate in street lighting practice for years to come, the marked advantages of mercury light sources deserve careful consideration.

First, eighty percent more light is obtained for the same energy from a 400-watt, mercury lamp than from comparable size incandescent source.

Also, the use of mercury lamps should reduce maintenance expense, because of longer lamp life. The 400 watt FH-1 and BH-1 lamps have a rated life of 5,000 hours, (for street lighting purposes) which means replacement on the average of only once every year. Some utility engineers have concluded that they should be able to operate the 16,000-lumen (400-watt) mercury lamp for approximately the same annual rate charged for a 10,000-lumen incandescent lamp.

Mercury lamps are not only meeting their rated burning life in actual roadway lighting installations, but in most cases are substantially exceeding this figure. The Denver installation, which uses about 1,000 400-watt mercury lamps, shows an operating record substantially exceeding the rated life of these lamps.

Then, too, the lumen output of 400-watt mercury lamps after reaching or exceeding the 5,000-hour rated life is unusually high. Recent tests of lamps which had burned well over 5,000 hours in actual service indicated an output of approximately 65 percent of rated initial lumens (16,000), or still from 25 to 26 lumens per watt.

Experience in Denver and other cities using mercury lamps alone for retail business street illumination indicates quite conclusively that the color quality of straight mercury illumination is not objectionable when used on streets with an average amount of electric signs and display window lighting. Some cities are even installing straight mercury illumination along residential-traffic streets and in civic centers, where there is no other type of illumination, with evident approval by the public.

The most economical and practical mercury lamps in use today for street lighting are:

(1) The 400-watt, 16,000-lumen base up (F-H1) and base down (B-H1) burning lamps which parallel the 15,000-lumen incandescent in application and are rated 5,000 hours when operated ten hours per start.

(2) The 250-watt, 10,000-lumen (C-H5) lamp which parallels the 10,000-lumen incandescent and is rated 3,000 hours life when operated ten hours per start.

A 100-watt (A-H4), 3,000-lumen, 1,000-hour rated lamp is available but at the present life rating and price is uneconomical for street lighting compared with equivalent-size incandescent lamps.

A modification of the 400-watt mercury lamp is known as the D-H1. Because of its smaller arc dimensions and the higher pressure under which the arc operates this lamp offers inherently higher efficiency and better optical control than the F or B-H1 lamp. It may be operated in any position, but its life is reduced when operated horizontally. This lamp is inherently more expensive than the F or B-H1. A great deal of work has been done on this lamp but its economic place in street lighting is yet to be proved.

The 400-watt lamps have a maximum over-all length of 13 inches and a light center length of 7¾ inches. The 250-watt lamp has an 8-inch maximum over-all length, with a light center length of 5 inches. The design of these mercury lamps is such that a ballast-transformer is required for satisfactory operation when connected either to a low-voltage multiple, or to a constant-current series circuit.

	Normal Power Factor		High Power Factor		Series	
	H1	H5	H1	H5	H1	H5
Trans. sec. open circuit volts	222	250	222	250	275	250
115 v. trans. pri. amp. start	9.0	7.5	3.2	2.7	6.6	6.6
115 v. trans. pri. amp run	5.9	4.2	4.2	2.4	6.6	6.6
Lamp operating volts	137	140	137	140	137	140
Lamp operating amp.	3.2	2.1	3.2	2.1	3.2	2.1

Experience is demonstrating that color quality is less a deficiency than at first supposed—Lamp characteristics have been improved—Operation on multiple and series circuits

The preceding tabulation gives the starting and operating voltage and currents on these two lamps for both multiple and series circuit operation.

Mercury lamp ballasts are available both in aerial and polebase types with the same general mechanical construction as that used for standard street-lighting insulating transformers. They are designed for both low-voltage multiple and series circuits, and, in the 400-watt size, are available in both high-power-factor (0.91) and normal-power-factor (0.67) types for multiple circuits. The 250-watt size is available only in the high-power-factor design.

Ballasts are not available in a high-power-factor type for constant-current series circuits, since such a capacitor-type series ballasts would introduce sufficient capacitance into the series circuit to cancel out the built-in reactance by which the constant-current transformer regulates, with resulting unstable current flow, undesirable starting current surges, probable shortened lamp life, and possible damage to the constant-current transformer. Where mercury lamps are connected to a constant-current series circuit, power-factor correction should be accomplished by using capacitors on the primary side of the constant-current transformer.

Normal wattage consumption of the combined lamp and ballast is:

Lamp	Using a Multiple Circuit Ballast	Series Circuit Ballast
400 watt	442 W. (high P.F.)	450 W.
250 watt	286 W. (high P.F.)	290 W.

The 400-watt lamps require approximately twelve minutes to attain full lumen output on multiple high-power-factor ballasts, and about seven minutes when operated on series and multiple normal power factor ballasts. The 250-watt lamp takes about four minutes to reach maximum output.

After a power interruption, from 5 to 15 minutes are required for cooling and for the pressure to be reduced to a point where the lamps will restart.

The 400-watt lamp ballast, high-power-factor type, is available for 115/230-volt circuits, and in the normal power-factor type either for a 115- or 230-volt circuit. The 250-watt lamp ballast is designed for a 115-volt circuit.

The primary input required by these multiple ballasts is:

Types	Primary Kva. Input to Ballast
400-W. high power factor type	0.49
400-W. normal power factor type	0.68
250-W. high power factor type	0.32

With the 400-watt capacitor-type ballast, momentary voltage dips of approximately 30 percent below normal can be encountered successfully without causing a lamp outage. This factor represents a considerable improvement over earlier types of ballasts. But if dips of more than 30 percent are frequent the advisability of using mercury should be carefully considered.

Mercury lamp ballasts for all commonly used series circuits are available for 6.6, 7.5 or 20-ampere circuits. These mercury lamps and ballasts can be operated on all types of constant-current transformers.

Each 400-watt lamp requires approximately 0.83 kw. of standard constant-current, series transformer capacity, and about 0.86 kw. of converted rectifier capacity. Approximately 0.63 kw. of automatic constant-current transformer capacity is required for each 250-watt lamp.

The reason why a mercury lamp consuming only 450 watts (lamp and ballast) requires approximately 0.83 kw. in constant-current transformer capacity is that such series ballasts are of the air-gap core design, which prevents destructive voltages across the ballast secondary upon lamp failure or possible removal from the socket. Also, these mercury lamps require a higher starting voltage and current than when in normal operation.

Therefore, this 450-watt ballast draws approximately 450-volt-amperes of reactive power in addition to the 450 watts of active (resistive) power from the constant-current transformer. Constant-current transformers are rated in kilowatts(assuming pure resistive load). The resistive load capacity is sharply reduced by the presence of a reactive component in the load because the constant-current transformer is highly reactive.

The secondary open circuit voltage on both normal and high power factor constant-current transformer, completely loaded with mercury lamps, is the same as for a similar incandescent lamp load. The full load secondary voltage, however, is only 72 percent of the incandescent full load condition.

Practice to date indicates some preference for clear rippled globes for utilitarian types of mercury installations. On retail business and downtown streets, where the 400-watt lamp is used, a light diffusing rippled globe is recommended.

The 400-watt mercury lamp can be substituted for all existing seven-inch light-center incandescent lamps used with a mogul screw-base socket, but a ballast-transformer must be inserted in the circuit, whether it is constant-current series or low-voltage multiple.

A pendant-type luminaire with self-contained mercury lamp ballast is not recommended, because the limited space in the luminaire causes serious wiring and design difficulties. Ballasts in such a fixture are exposed to the heat of the lamp and to moisture condensation, against which it is difficult to afford protection. For more trouble-free installations, separate ballasts are recommended.

Closed Minds and Complicated Rates Hamper Power Selling

L. A. BLACKBURN*
Slaughter, Saville & Blackburn, Inc.
Richmond, Va.

IN OUR DEALINGS with power salesmen we have on occasions been confronted by closed minds that will not admit other viewpoints, particularly in negotiations in which our clients were considering installation of generating equipment. I am not making the charge that this stand is taken deliberately, because I really feel that the power salesmen were as sincere in their beliefs as we were sure of our findings. We have made reports which were criticized as unsound, but which prevailed, and after the installations were made the final results proved better than our estimated forecasts.

As I see it, the power engineer who takes the positive stand that the power company "can do it for less" bases his assumption on poor installations he has seen, not on well designed, well managed installations. He has put too much time on the one side of the problem that gives him the "no" answer. The calculations are not difficult in most cases—to the contrary, rather simple—but to discourage the prospect he feels he must point at the poorly designed layout as a horrible example.

We have also found some utility men slow to admit it when they know we consulting engineers have the right answer. They find fault with the method of cost allocation or the lack of an accounting system to determine accurately the kilowatt-hour cost. As a matter of record, it would be almost impossible in many cases to determine this cost exactly because of the various multi-duty employees in the smaller industries and municipal operations. In the case of municipal accounting, there are wide differences of opinion as to compilations of cost.

Aside from dry mathematical calculations, there are nearly always two approaches to a problem, and there are two groups of thinkers: one in favor of, and one that is against. Neither group alone can render an impartial decision but with an open mind the two sides can get together and by thoroughly discussing the problem, if they are fair-minded people, they can settle the points on a fair and equitable basis.

The tool that you use most in your profession is a rate schedule. Doubtless every one of you has in your possession a book that is about one and a half inches thick, that has all of the rates of all the utility companies in the United States. I doubt if each one of you can make a complete analysis of every rate that is in that book. I am absolutely sure that I could not, and I am just as sure that too large a percentage of power consuming industries do not have men who can completely analyze them. But when all is said these rates are nothing more than ways of putting a price on a service. They all resolve themselves to an answer to "How much per kilowatt hour?"

But when we discuss the cost per kilowatt-hour, invariably there is no way for the average citizen who is paying the bill, except the domestic customer, to follow the method of calculation in the rate and arrive at the answer. Now, what am I getting at? Some of you may have guessed. Well, let's bring up the old much-debated question and put it on the table and see why across the country there are a hundred different ways of calculating the cost of kilowatt-hour of three-phase energy. Why? Not because of the method of generation, not because of the frequency, the voltage, the distance of transmission, or any of the other

technical considerations. The cause of these differences, in my opinion, is that rate makers love complications and insist on throwing all of the factors—regardless of their weight—into rate structures.

As I see it, every client that you have will discuss with you what is his cost per kilowatt-hour. You have solved this problem so far as the domestic consumer is concerned—and I think this may have been forced on you! Unquestionably you

* Mr. Blackburn presented these arguments at a recent meeting of the Interstate Power Club of New York.

Looking at the competitive situation from the other side, a consulting engineer tells what he sees as wrong in the methods and attitudes of power salesmen

are approaching the time when someone is going to ask you why a uniform method of determining a power bill cannot be adopted as a standard from coast to coast.

As one of my power engineering friends expressed it to me, why not have a blank form for a bill showing a standard method of calculating and each power company would insert in that form quantities and factors to fit its particular conditions. I know that sounds fantastic to you—and it may be. Such a change however would accomplish three things: reduce the number of people who are employed to make these calculations; reduce the number of people who spend time making them complicated; and establish a simple, understandable method of calculating cost of one of the most used services in business.

Engineering Analogy

Let us take the consulting engineer's position now for a moment. Suppose in our engineering calculations it was necessary for us to use complicated formulas for the determination of our engineering facts. I doubt if the engineering profession would then be profitable in today's economic conditions. Without the use of mechanical, electrical and civil engineering handbooks we would be lost, but admittedly these tables and calculations prepared for us cannot be safely used except by engineers who understand the background of the development of these tables. In other words, it is quite disastrous for a young graduate engineer to rely entirely upon tables; so my approach to this problem is based on my experience in the engineering field where far more complicated calculations have been reduced to understandable sets of figures, I believe that the same thing can be applied to the rate structures if the same caliber of men would do the same amount of work in reducing your complicated rate structures to understandable engineering handbook reference.

A Specific Case

A few years ago we were employed to discuss with a town council the advisability of making a fight for a reduction in rates, as they felt that inasmuch as the local system was not physically tied in with the rest of the system that the earnings were exorbitant for that particular place. As a whole, the council was right. Some of the men on the council were good, hard-headed business men and they could get to the answer in a businesslike way, as they do so often in determining a quick answer to their own problems, and they told us offhand, that they figured that the company was making about 25 percent return on its investment. That rather shocked me because I had taken several weeks to get to the same answer.

I daresay that at that time the policy of the power company would have been that "you fellows don't know what you are talking about," and they would try to convince them that they were wrong and probably wind up with either a rate case or a long drawn out argument of some kind. We made a different approach to the problem. We told them that what they needed was not an isolated system but one connected by transmission lines with the rest of the system, because of the fact that they were too vulnerable tied up with only one source of power. It is true that they had a remarkable operating record but it was also true that plant capacity could be speedily outgrown. We immediately began to discuss with the state commission the advisability of requesting the power companies to build a transmission line and supply this area with additional power. Fortunately for them the line was built, and if it had not been, activities in this area during the recent war would have been handicapped.

You fellows make a lot of work for consulting engineers, and inasmuch as I am a long way from home, I don't think that what I have to say along that line is going to affect our own business, but many times when we have been called in as consulting engineers we have only done what you could have done for the client to begin with and made him much happier. You close your mind in many instances against helping a customer find a way to get a lower rate than you have in the book.

It is more or less such an "I don't want to see or know" attitude that quite often puts your group—or any group, so far as that is concerned—in a bad light. In our practice we try to operate with an open mind, try to be impartial and to give our clients broad answers to their problems, not only how does it affect them today, but what will be the effect in the years to come?

It might be a good idea for the power salesman to use that technique once in a while to think over the reasons why it might be better for the prospect not to sign the contract. He might then be able to counter those reasons with good arguments which is more convincing to the prospect than obstinately insisting that such reasons do not exist.

Magnetic Governor Release for Standby Operation

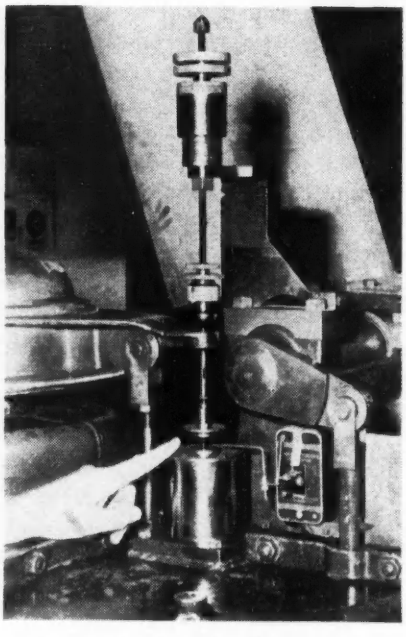
B. H. MUDGETT
Pacific Gas and Electric Co.,
Martinez, Calif.

IN THE OPERATION of steam-electric generating stations, especially in conjunction with hydro plants, it is often desired to operate units on block load or to limit the maximum load a machine will normally carry. With any load blocking device some provision must be made to free the turbine governor from the restraining influence of the device in case of an abnormal drop in frequency that calls for the machine to carry additional load up to some predetermined maximum.

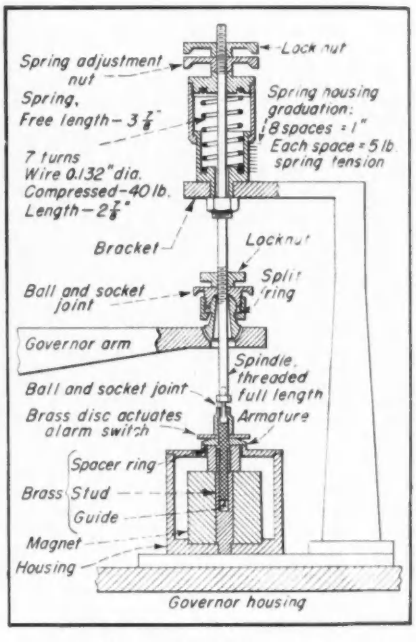
Stabilizing devices used for many years have undergone successive changes and improvements in design, culminating in a special type of magnetic stabilizer consisting of a mechanical arrangement whereby the pull of the governor arm beyond a set value breaks free the armature of a permanent magnet and allows the governor to take over control of the turbine. An important feature is an adjustable compensating spring acting in opposition to the pull of the magnet.

Essential requirements of governor restraining devices are that they must be (1) simple to operate and maintain; (2) usable through the full governor range of the turbines; (3) insensitive to normal frequency or speed variations; (4) so designed as not to restrict the governor from acting in a pre-emergency capacity to close the control valves in case of extreme high frequencies. The present stabilizer meets these conditions very satisfactorily.

To construct a device of this nature, it must be decided at what frequency drop the release is to operate. Then it will be necessary to determine how many pounds' force the governor beam will exert for a given deviation from normal speed. It is also necessary to know the full travel of the governor arm from its lowest to its highest load and speed positions.



MAGNETIC STABILIZER permits turbogenerator to carry block load, yet respond to speed-governor action in case of abnormal frequency drop. Governor beam travel is restrained by pull of permanent magnet. Pull required to lift armature from magnet is made variable by compensating spring on upper end of spindle



CUTAWAY DRAWING of magnetic governor release showing principle of operation

A good grade of permanent magnet that will give three or four times the pull to be exerted by the governor beam should be selected. The compensator spring must be heavy enough to separate the armature from the magnet before the spring is fully compressed. Spring position calibrations should be marked on the housing for the purpose of testing the magnet and for setting the release to operate at the required drop in frequency.

One of the main advantages of the design lies in small and light moving parts. When the governor separates the magnetic release, the parts that are carried on the governor arm—the spindle, armature assembly, and the two adjusting and locking nuts—weigh only a few ounces. This slight weight makes no appreciable difference in the governor characteristics. However, with the incorporation of the latest improvement, the compensator spring, even this small amount of weight is lifted clear of the governor beam through the action of this spring. It is a simple matter to render the device inoperative by raising the ball and socket nut well clear of the governor arm and locking it in this position.

It was found that for the particular turbines for which this release was

designed, with approximately one cycle drop in speed the governor would exert an upward force of 14 lb. at minimum loads and 9 lb. at or near maximum loads. The magnets selected required 40-lb. straight pull to lift the armature from the pole face. From this it was determined that there must be a compensator spring pull of 40 minus 14, or 26 lb. at minimum loads, and 40 minus 9, or 31 lb. at maximum loads. Spring position calibrations on the housing for each 5 lb. below 40 were found to be fine enough. In actual operation, with release desired at between one-half and one cycle, it was found that a compensator setting between 25 and 30 lb. for minimum loads, and between 30 and 35 lb. at or near maximum loads gave excellent results.

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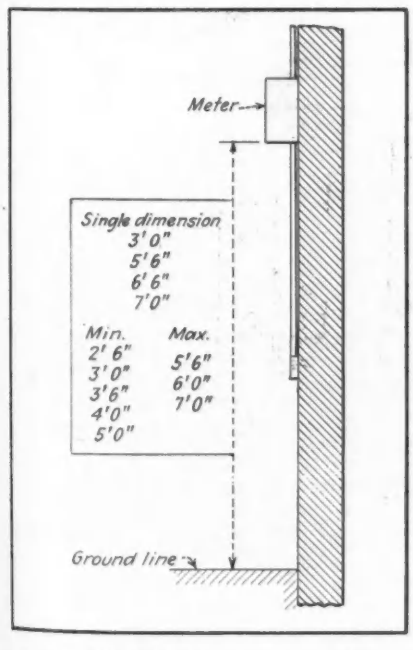
An ELECTRICAL WORLD *Comparison of Service Practices*

IV—Variable Details in Service Rules Have Top Importance

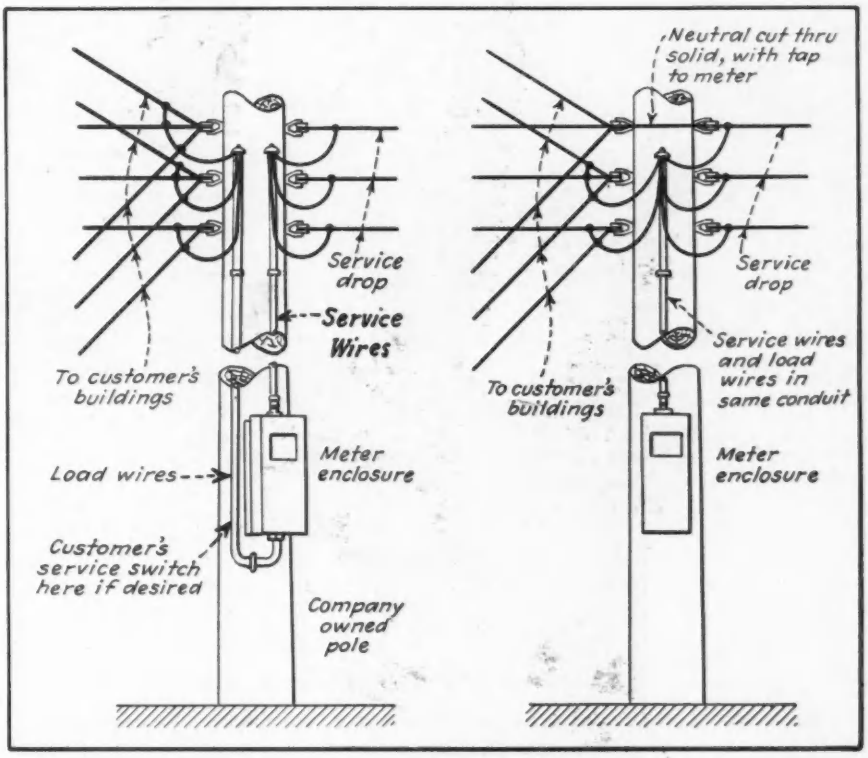
Local practices have been affected by standards in material—Variations in details are not extensive

SERVICE ENTRANCES from distribution secondary mains, including the service drop, entrance wiring, meter and circuit protection, receive the most attention of any section in utility rules and regulations for electric supply to customers. There are many details to be covered in arrangement, dimensions, locations of meters and connections. Company property is integral with customer property at this point, and certain standards are essential to practical operation and satisfactory relations.

National Electrical Code requirements are especially concerned with prevention of possible fire and other hazards, and have no bearing on the completeness or suitability of the installation. Local conditions and practices that have developed through many years govern most of the details not subject to the measure of safety. The following comparison of practices is based on a review of rules and information manuals or drawings issued for service installation by 24 companies.



WIDE VARIATIONS appear in the mounting heights specified for outdoor meters

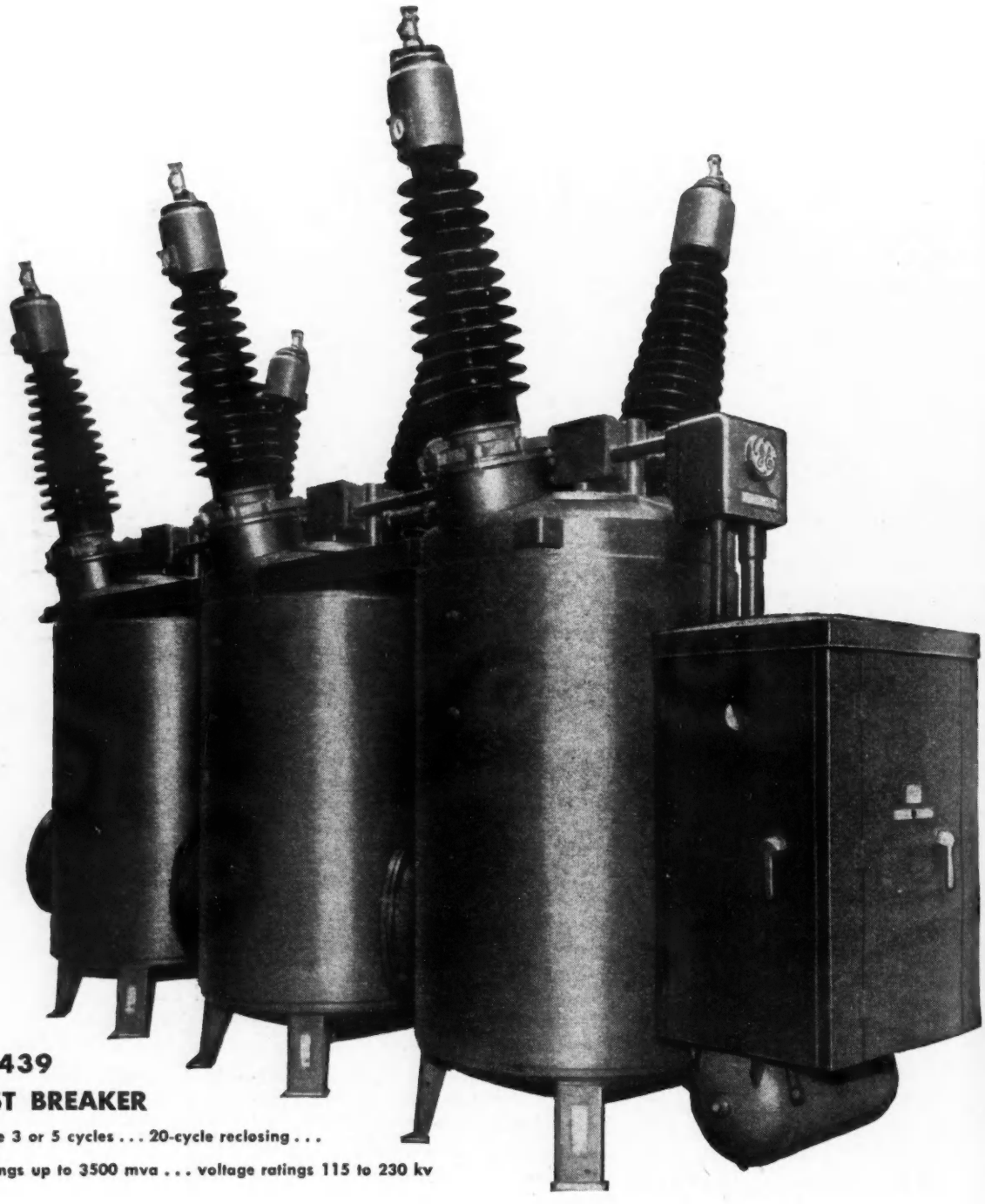


METER and service poles for farm-yard service to several buildings are recommended by several companies. Two variations are shown

Service Attachment. Overhead service wire attachment to the building is usually the most troublesome problem connected with residence services. A support is needed that is substantial enough to withstand the tension of the service drop, and clearances must be provided over drives, or walks and often over the street. No company service manual shows a standard method of installation that is applicable to all conditions, and many details are concluded with a phrase as, "in the judgment of the service inspector."

Service booklets of three companies refer to attachment racks for which

NOW GE HIGH-VOLTAGE WITH COMPLETELY



TYPE FK-439
OIL-BLAST BREAKER

Interrupting time 3 or 5 cycles . . . 20-cycle reclosing . . .

Interrupting ratings up to 3500 mva . . . voltage ratings 115 to 230 kv

BREAKERS

SEALED BUSHINGS

FOR REDUCED MAINTENANCE

Twelve-years' experience with over 80,000 moderate-voltage sealed bushings gave General Electric the background for developing these pressure-tight bushings for high voltages. Complete protection against contamination of the internal insulation structure means maintenance costs are reduced.

- **The initial high dielectric strength of the liquid and solid insulation is maintained by the completely sealed construction which prevents the entrance of air or moisture. Since the expansion chamber is made of metal, the insulating liquid is not exposed to the deteriorating effects of sunlight.**
- **The initial power factor of the bushing is low, and remains low in service, giving assurance that the bushing is in good condition and free from deterioration.**
- **The magnetic liquid-level gage provides an accurate indication of the oil level in the bushing. Even if the glass enclosing the dial is broken there is no danger from leaks or from moisture entering.**
- **When excess potentials, either 60 cycles or impulse, are applied, the bushing will repeatedly flash over externally rather than puncture or shatter.**
- **Bushings in storage are always ready for immediate installation.**

The FK-439 breaker also has a new lightweight interrupter that assures faster circuit interruption. High-speed reclosing is accomplished by the smooth positive action of the pneumatic mechanism. In addition to facilitating maintenance by increasing the accessibility of operating parts, redesign has also decreased the tank dimensions and over-all unit weight. Call or write your G-E sales representative for bulletin GEA-4407 which tells the complete story of the "439" breaker. *Apparatus Department, General Electric Co., Schenectady 5, N. Y.*

Standard 138-kv Completely Sealed Bushing

GENERAL ELECTRIC

they will supply the necessary bolts and fittings for installation by the contractor at the time the building is being constructed. One company furnishes a service rack anchor for use on low buildings of stucco, brick, stone or glass veneer.

Service Entrance. Approved service entrance cable, in addition to rigid conduit, is specifically approved for service entrance installation in all except five of the 24 service manuals. All companies show service entrances installed on the outside of buildings, but two companies also show conduit concealed in the outside wall as a permissible method.

Meter Location. Meters are shown connected ahead of the service switch, in the sequence meter-switch-fuse on all of the installation diagrams for single-phase services, and it is stated as a requirement for new and reconstructed services in most rules.

Fifteen companies install meters outdoors as a general practice, and four more specify outdoor installation in rural or non-gas areas of the service territory. These four use indoor metering in urban or gas service areas, and two companies install meters indoors as a general practice. Three companies state that either indoor or outdoor installations will be made.

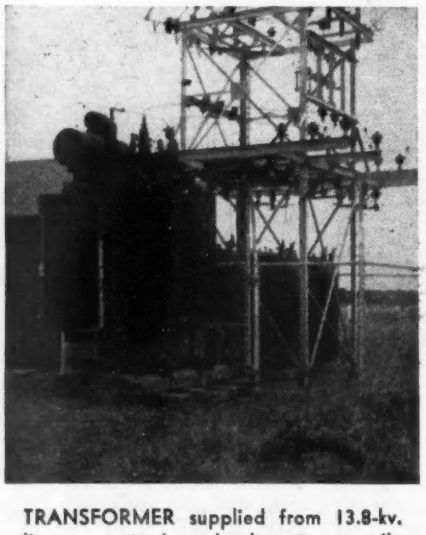
Pole Mounting. Installation of the meter on a pole, which may be used as a distribution center to serve the house, barn and other buildings, is quite common in rural areas. Practice appears to be divided on the use of a main disconnect switch with the pole mounted meter. One company drawing shows service wires and load wires in the same conduit on the pole. In this case also, the neutral connection is cut through solid at the pole top, with a single wire down to the meter and ground connection.

Meter Mounting. Distance of outdoor meters above the ground appears to be variable over the widest possible range. Single dimensions are given from 3 ft. to 7 ft. and minimum to maximum dimensions are shown from a band of 2½ ft. to 6 ft., up to 4 ft. to 7 ft.

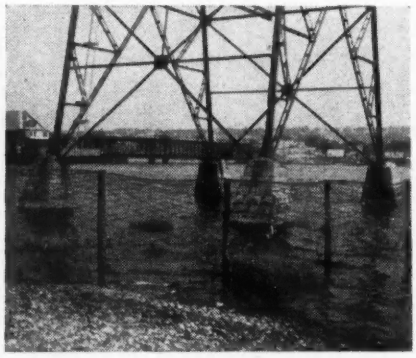
• • •

"Temporary" Installations Need Accident Protection

RECENT STUDIES of public accident hazards on poles, towers and structures made into a series of slide films by the Liberty Mutual Insurance Co., Boston, brought out a number of conditions potentially unsafe in relation to so-called temporary installations and operating situations where such lines are exposed to the adventurous instincts of children. In one case load conditions called for the installation of a supplementary transformer several years ago, and this was placed outside the substation inclosure. Inspection spotted an easy climbing path to the top of the tank and threatened contact with the 13.8-kv. leads from line to transformer; this was brought to the attention of suitable utility officials, fortunately before accident occurred.



TRANSFORMER supplied from 13.8-kv. line presents hazard when temporarily left outside fencing



PROTECTING high-tension tower by barbed wire fencing parallel and also at right angles to shore line

On a routine inspection a utility employee noticed that the grass was matted in a drainage ditch under a fence surrounding a substation. A path led across a field to a house. Inquiries revealed that the children had been playing around the substation and that some had undoubtedly entered the enclosure by crawling through the ditch under the fence. The inspector's prompt report led to the installation of a drain pipe making it impossible to crawl under the fence. In another case the towers of a 66-kv. line were provided with steps bolted to the legs. A fatal accident occurred when a boy climbed up these to a crossarm 69 ft. above ground and came in contact with a phase wire loop. Removing the steps permanently for a distance of 8 ft. above ground greatly increased the protection because of the difficulty of "shinnying" up the steel angle-iron leg or climbing the diagonal braces to reach the 8-ft. level.

Added Fence to Keep Off Swimmers

Initially a steel tower carrying a 66-kv. circuit at a tidal river crossing was provided by a steel ladder for company use. It extended within about 10 ft. of the water level at low tide; but at high tide it was possible to get upon the stone piers carrying the tower and thence to reach the ladder. For some time it had been the custom of swimmers to dive from the tower into the river, leading inevitably to competition to make the highest dive. A fatality followed a boy's making contact with a phase wire. Since this accident the company has built a barbed wire inclosure around the tower base, extending around the inland side and out into the water to make the tower inaccessible even at high tide except to a good swimmer. The police have been notified and have cooperated in discouraging swimming around the tower base.

what's new in GE street lighting

New insulator replaces Five designs

GENERAL ELECTRIC announces the new Form 45H7 wet-process porcelain insulator for series street-lighting luminaires. This improved insulator supersedes, and is interchangeable with, Forms 45H1, 45H3, 45H4, 45H5, and 45H6 designs.

You can now get this new insulator, and luminaires embodying it, at no increase in price. Current orders will be filled with insulators of the new design.

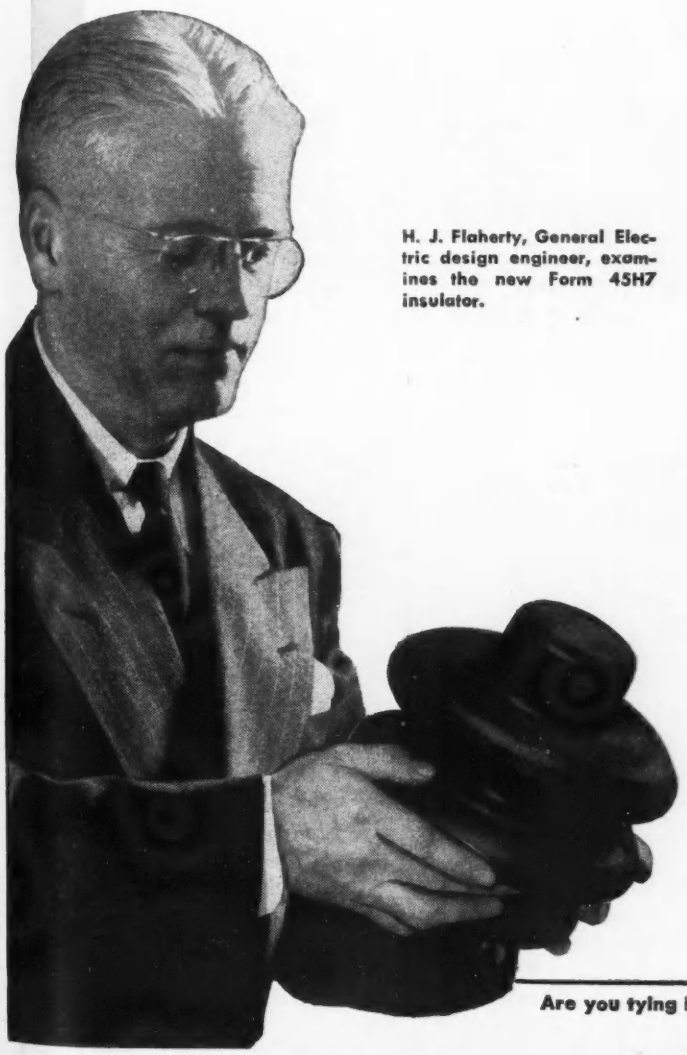
Features of the Form 45H7 Insulator

Among the improvements found in this new insulator are these:

1. Two "petticoats" instead of one lengthen the external creepage path and double the dry path under rain and sleet conditions.
2. A bottom bead has been added, strengthening the lip and preventing breakage.
3. Either internal or external wiring can be used. Terminal extensions, providing external binding posts, can be mounted in the lead openings when desired.
4. Light-center is accurately positioned by the socket receptacle, which is cemented into place. Dependable connections are assured.
5. Integral porcelain tie-lugs are provided in the lower "petticoat" to remove strain from terminals—less possibility of causing radio interference.

Standardized line of wet-process porcelain insulators

The new Form 45H7 is the insulator to use with high-voltage aerial wiring. With the Form 72, for duplex cable, General Electric's line of high-quality wet-process porcelain insulators is now reduced to two standard designs, which will meet all requirements —and which are suitable for all types of mounting and for any selection of reflectors or reflector-glassware combinations.



H. J. Flaherty, General Electric design engineer, examines the new Form 45H7 insulator.

GENERAL ELECTRIC

422-45

GOOD STREET LIGHTING BUILDS GOOD WILL

This improved insulator is another of General Electric's contributions to help you provide better street lighting at lower cost. For additional information call our nearest Apparatus Office or write to *General Electric Co., Schenectady 5, N. Y.*

Are you tying in with the NEMA plan to give America better street lighting?

How to Calculate Capacity Of Cable Shipping Reels†

ACCOMPANYING FORMULA is used in determining the capacity of shipping reels:

$$F = \frac{\pi}{12}\left[B + \left(\frac{A - 2X - B}{2d}\right)^{*} d\right]\left[\frac{A - 2X - B}{2d}\right]^{*}\left[\frac{C}{d}\right]$$

where

F = feet of cable on reel
A = flange diameter, inches
B = drum diameter, inches
C = inside traverse, inches
d = diameter of cable, inches
X = clearance under lags, inches
$*$ = Use whole numbers only; i. e. drop fraction of turns

Table I lists typical reel dimensions and Table II gives values for clearance under lags.

EXAMPLE

Problem: How many feet of cable whose O.D. is 0.920 in. can be put up on a 42-in. × 24-in. × 24-in. reel with 3-in. clearance

Solution: $A = 42$ in.; $B = 24$ in.; $C = 24$ in.; $d = 0.920$ in.; $X = 3$ in. Then substituting these values in the foregoing formula,

$$F = \frac{\pi}{12}\left[24 + \left(\frac{42 - 6 - 24}{1.840}\right)0.920\right]\left[\frac{42 - 6 - 24}{1.840}\right]\left[\frac{24}{0.920}\right]$$

$$F = \frac{\pi}{12}\left[24 + \left(\frac{12}{1.840}\right)0.920\right]\left[\frac{12}{1.840}\right]\left[\frac{24}{0.920}\right]$$

$F = 1{,}205$ ft.

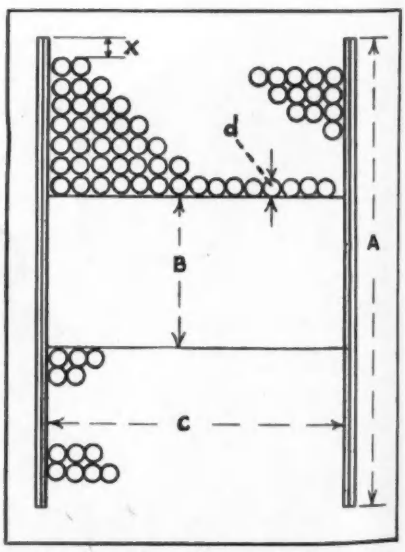
Table I—Typical Reel Dimensions for Rubber Insulated Cable

A inches	B inches	C inches	A inches	B inches	C inches
24	14	6	54	32	32
24	14	10	60	32	32
24	14	16	66	40	36
28	16	8	72	48	36
30	14	14	78	48	36
36	16	18	84	56	36
42	24	24	84	56	48
48	24	24			

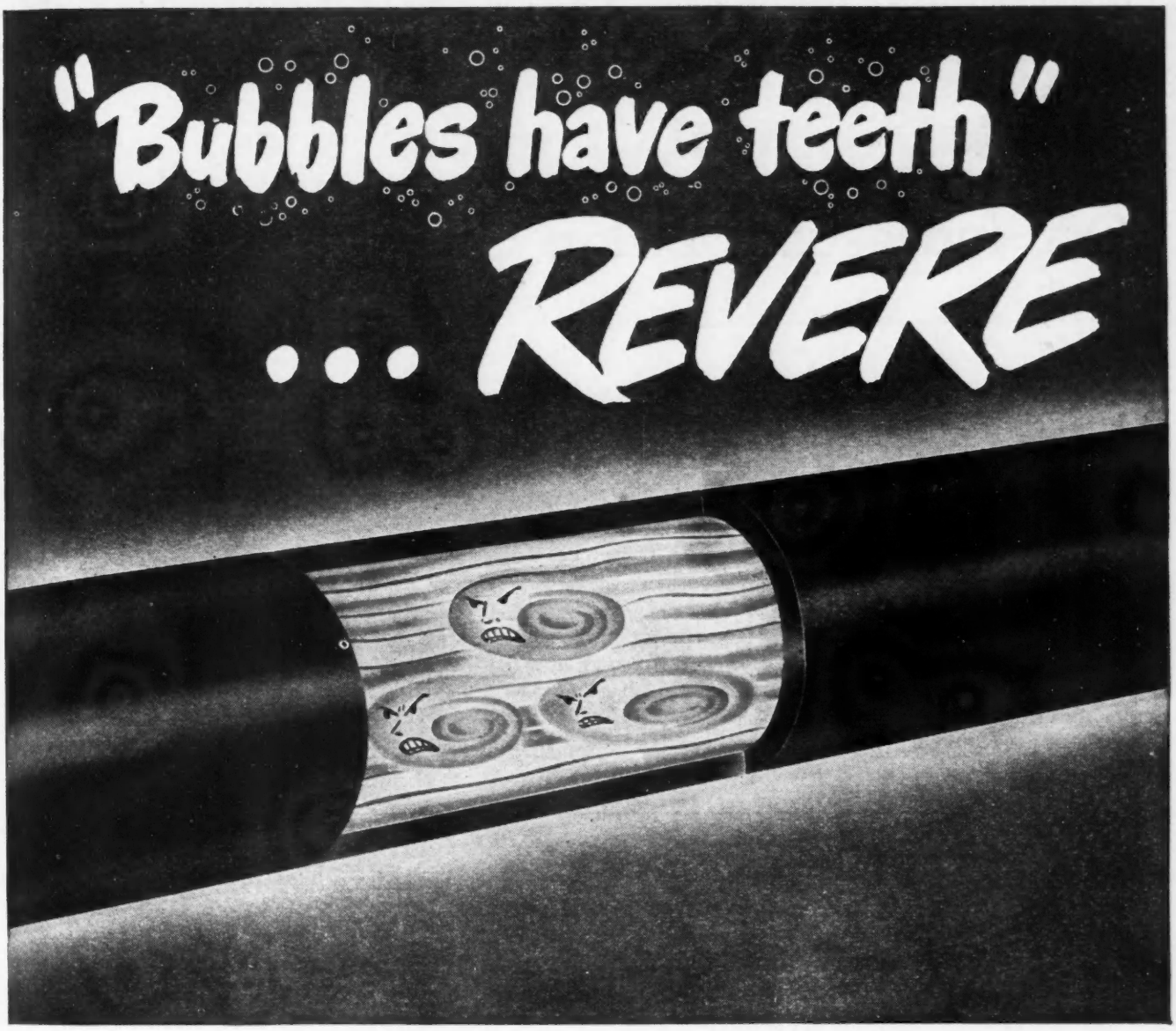
Table II—Clearance Under Lags

Reel Flange Diameter, Inches	Value of X, inches	
	Plain Lead Covered Cable	All Other Cable
24–36	3	2
48 and larger	4	3

† From advance pages of a technical manual to be issued by Rome Cable Corp., Rome, N. Y.



CABLE REEL outline and dimensions



SOME years ago Revere said that "Bubbles have teeth." It is still true. Air bubbles in a condenser can eat away at the tubes quite rapidly, and become a cause of failure with consequent re-tubing. Air-entrainment, as it is called, acts in several ways, all destructive to tubes. Air contains oxygen, which directly attacks most metals, forming oxides. Carbon dioxide in solution dissolves these oxides. That is not all. Air bubbles add to the erosion effect of turbulent flow. The higher the velocity, the worse the effect, and the more swift and serious is the combination of erosion and corrosion at points of greatest disturbance. Every effort should be made therefore to keep air from being carried into the cooling water. If you are troubled by frequent re-tubing of your condenser, get in touch with Revere, but first save a few samples from failed tubes for examination by our laboratories to determine the cause of failure. Many users of condenser tubes have found our collaboration exceedingly valuable, and we are always glad to cooperate in an effort to extend tube life.

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Check Electrical Characteristics Of Fluorescent Lamp Circuit . . . I

Five steps for an elimination process to locate faulty element in a fluorescent lamp fixture. A method to check lamp performance will be outlined in an ensuing issue

HARRIS REINHARDT
Manager, Commercial Engineering Dept.
Sylvania Electric Products Inc.
Salem, Mass.

EXPERIENCE in servicing fluorescent lamp installations has indicated that the greater percentage of calls involve a lamp which flickers or fails to light. The problem is usually one of determining whether it is the lamp, starter, or ballast which is at fault. For such troubles the use of a special test kit is not required.

A simple routine of checking the lamp and starter in a fixture or test circuit which is known to be operating satisfactorily will usually be found entirely adequate. In some instances it will be found that a short-circuited starter or a dummy starter, with leads from the contacts brought out to a snap switch to constitute a manual starter, are helpful in this problem of locating the faulty element by a process of elimination. A simplified procedure for checking a fluorescent lamp circuit in this manner is outlined here.

A Procedure to Check a Fluorescent Fixture When a Lamp Fails to Light

1 — CHECK CONNECTIONS

The first and important step is to make sure that proper connections have been made to the line and that voltage is available at the fixture. If those items have been checked but the lamp fails to light, the next four steps may be followed to locate the cause of the trouble.

2 — CHECK LAMP

Make sure that the lamp is not defective by checking it in a fixture which is known to be operating properly, or replace it with a lamp which has been checked and is known to be good.

3 — CHECK STARTER

If the lamp which is known to be good will not light in the fixture, remove the starter from the fixture and replace it with a starter which has been checked and is known to be good. If the lamp will not light with this starter it indicates that something is wrong with the wiring or the ballast.

Alternative. Another way to check the starter is to use a short-circuited starter or "dummy" starter with leads from the terminals brought out to a snap switch. When a short-circuited starter is in the fixture there should be a fluorescent glow from each end of the lamp, as during the pre-heating or starting period. If this occurs it is a reasonably good indication that the circuit is properly connected. If it is possible to start the lamp by quickly removing the shorted starter, it indicates that the original starter was the cause of the trouble.

4—CHECK SOCKET CONTACT

With the short-circuited starter in the starter socket, twist the lamp gently in the lampholders to see if contact can be made. Connections of the lead wires at the lamp sockets should be checked to make sure they are tight. If a combination lampholder and starter socket is used the connection between the two should be checked to make sure that good contact is being made.

5—CHECK WIRING AND BALLAST

If a check on all of the foregoing does not disclose the defective part, the entire wiring of the fixtures should be checked. If this is not defective then it may be assumed that the cause of the trouble is in the ballast, and it will have to be replaced. A continuity check for open circuits, short circuits, or grounds in the ballast, to determine the exact nature of the defect, may be made if desired.

"Planned Lighting" Plus

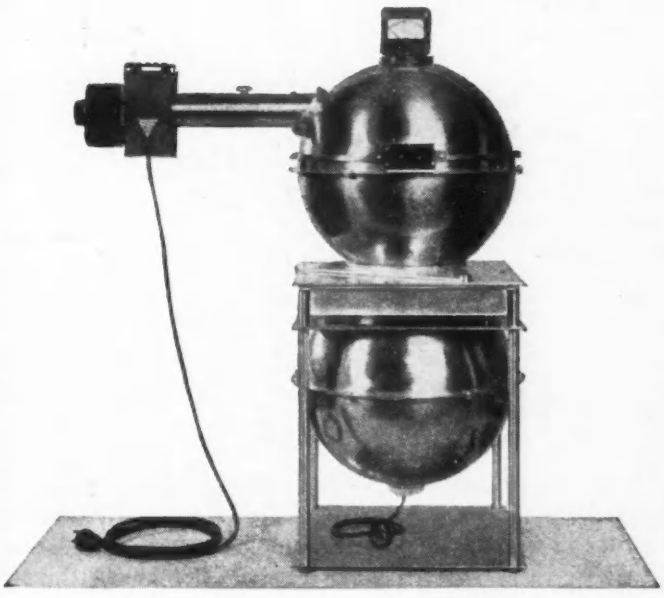
G-E Lamp Department has developed a full line of meters to help you demonstrate and merchandise better lighting

WE'RE in the *lamp* business. So our basic responsibility to consumers continues to be the production of an ever-increasing line of quality light sources for every purpose. But our job doesn't stop there. In many other ways the G-E Lamp organization works constantly to stimulate modern lighting practice in homes, stores, offices, factories and public institutions.

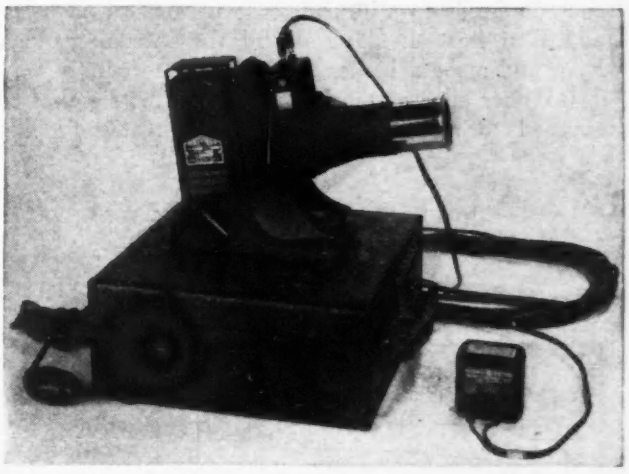
For example, General Electric Lamp engineers know the vital importance of convenient, accurate light measurement as a part of Planned Lighting. So they have developed a full line of meters for the complete analysis of illumination—both quantitative and qualitative. Typical G-E instruments are illustrated and briefly described on these pages. These Planned Lighting tools are available to you—at manufacturer's cost—for the use of your lighting specialists.

* * *

FOR ADDITIONAL INFORMATION *on G-E light meters for Planned Lighting, their application and prices, contact your nearby General Electric Lamp Office. Or write General Electric Lamp Department, Dept. 166-E-5, Nela Park, Cleveland 12, Ohio.*



BAUMGARTNER REFLECTOMETER—A portable, moderately priced instrument for evaluating the reflection and transmission factors of translucent plastics, porcelain enamel, paint, acoustical and other materials of importance to the lighting profession. Operates independent of visual observation. May be used also to measure the reflection factor of walls and ceilings.



PROJECTION LIGHT METER—A handy portable instrument for projecting the standard General Electric light meter face on a screen. Facilitates demonstration to large groups. Projection meter may be used for taking readings up to 100 footcandles.

G-E LAMPS

GENERAL ELECTRIC

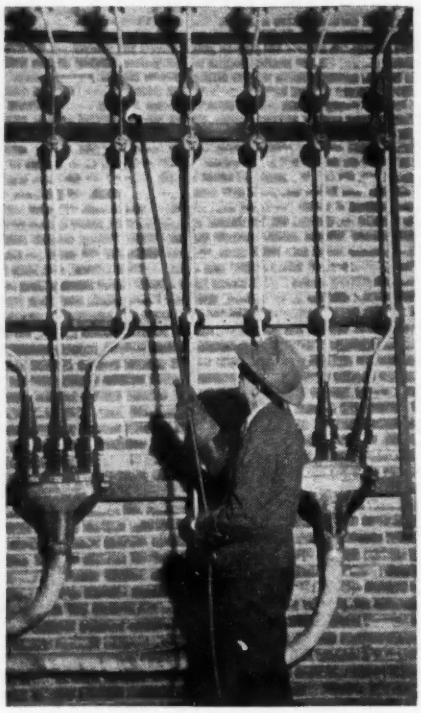
Hooked Switch Stick Used For Testing and Phasing

CHARLES L. KELLER
Assistant Superintendent
Underground Dept.
The Toledo Edison Co.
Toledo, Ohio

DESIGNED and built in the shop of the Toledo Edison Co., a long rigid insulated terminal is now being used for testing insulation and phasing on 4-kv. disconnects; its purpose is to prevent accidental contact with adjacent energized lines. The test stick replaces a switch pole with wire attached to the end, a combination that had to be shoved up between "hot" switch blades. New method is considered safer.

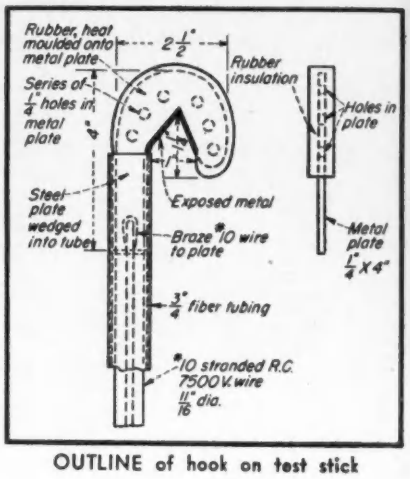
A stick consists of No. 10 stranded rubber-covered wire of 7.5-kv. rating within fiber tubing $\frac{3}{4}$ in. ID and 6 ft. long.

On the working end of the stick the wire is attached by brazing to a hook made from flat steel strip, bent and then covered with rubber. Holes are drilled through the hook, the insulation built up with rubber tape, and then heat moulded to fill the holes and make a homogenous mass. The innner edge of the hook is then exposed to make contact with the switch blade. The hook is held in place at the end of the fiber tube by wedging and cementing. Conventional terminals were installed at the remote end of the cable for connection to test or phasing equipment.



TEST STICK service in a substation

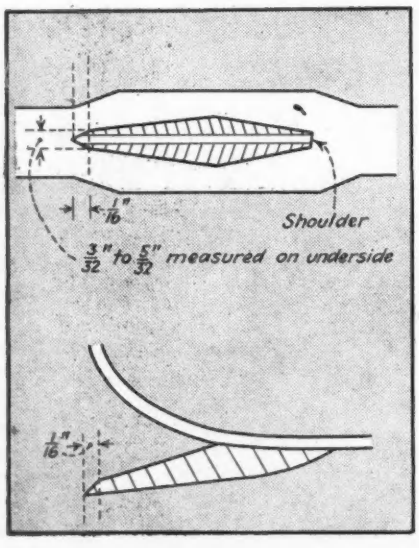
CONTACT end of test stick


Rubber, heat moulded onto metal plate
2 1/2"
Rubber insulation
Series of 1/4" holes in metal plate
Holes in plate
Steel plate wedged into tube
Exposed metal
Braze #10 wire to plate
Metal plate 1" X 4"
3/4" fiber tubing
#10 stranded R.C. 7500 V. wire 11/16" dia.

OUTLINE of hook on test stick

• • •

How to Sharpen Climber Gaffs



CLIMBER GAFF POINTS when properly sharpened should have the shape and dimensions shown

A STUDY of available recommendations on how to sharpen climber gaffs, undertaken by the Bureau of Safety, Inc., subsidiary of Middle West Service Co., Inc., Chicago, resulted in the following recommendations:

1. Never use a grinding wheel; always a good file. A grinder will heat the metal and destroy its temper.

2. Place the climber securely in a vise, gaff up; stirrup down. Wood blocks may be used as cushions in the vise jaws.

3. Stroke of the file is from the heel of the gaff toward the point.

4. Remove only that metal on the two outer side slopes which will restore their original shape and the original edges where these two slopes join the under surface.

5. In removing metal from the outer side slopes, stay away from the rounded shoulder as much as possible. No metal should be removed from it except what little might be necessary at or near the point to bring it back in line with its original shape. In other words, do not change the shoulder. Also, avoid filing away more metal from one side slope than from the other. Balance the two sides with the shoulder as a center.

6. Never file the under surface of the gaff, except as explained in No. 8. The manufacturer has set this surface at such angle as will make the gaff cut best into the pole.

7. File so that the final point will be located in the center of the shoulder and not to one or the other side of

BURKE'S *New Induction Motor*

RESULT OF 41 YEARS INDUCTION MOTOR EXPERIENCE

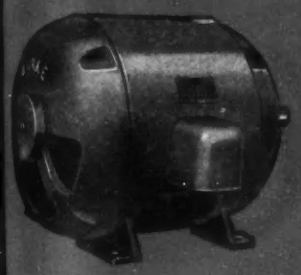
Rotor LAMINATIONS OF HIGH GRADE ELECTRICAL SHEET STEEL, SECURELY KEYED TO SHAFT SPIDER. ROTOR BARS OF HARD DRAWN COPPER STRIP FIRMLY EMBEDDED IN PARALLEL CLOSED ROTOR SLOTS. EXTENSION OF ROTOR BARS PROVIDES AMPLE FAN ACTION FOR EFFICIENT VENTILATION.

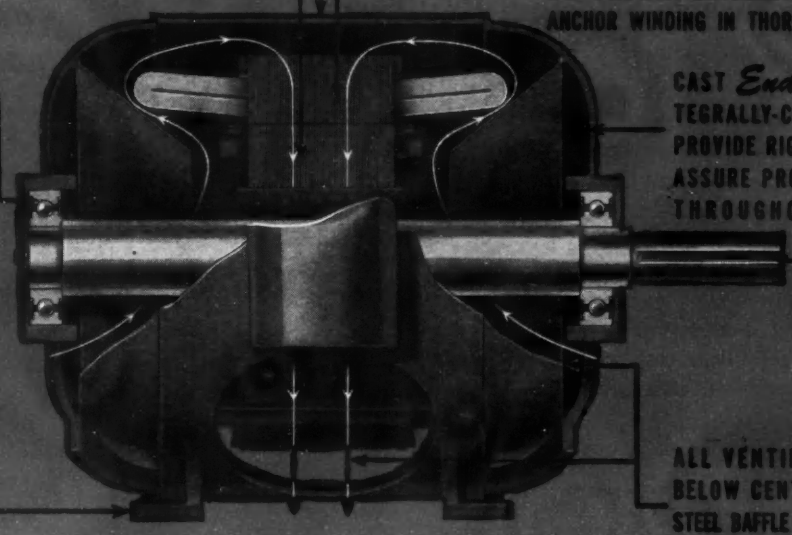
Frame OF ROLLED, WELDED STEEL FOR GREATEST RIGIDITY WITH MINIMUM BULK AND WEIGHT.

Stator CORE, OF HIGH GRADE ELECTRICAL SHEET STEEL, IS INDEPENDENT OF SUPPORTING FRAME; AND RIGIDLY WELDED INTO PLACE TO MAINTAIN PERFECT ALIGNMENT. STATOR COILS ARE WOUND WITH NEW SYNTHETIC RESIN-COVERED WIRE PROVIDING EXCELLENT DIELECTRIC STRENGTH AND MAXIMUM EFFICIENCY. FIBRE WEDGES SECURELY ANCHOR WINDING IN THOROUGHLY INSULATED SLOTS.

Ball Bearings ARE OF DOUBLE SHIELD, PRE-LUBRICATED TYPE. NO FURTHER LUBRICATION NECESSARY DURING NORMAL LIFE OF MOTOR. PRESS FIT ON SHAFT ELIMINATES NEED OF LOCK NUTS AND WASHERS. SLEEVE BEARINGS ALSO AVAILABLE.

CAST *End Brackets* WITH INTEGRALLY-CAST BEARING HOUSINGS PROVIDE RIGID SUPPORT FOR ROTOR, ASSURE PROPER SHAFT ALIGNMENT THROUGHOUT LIFE OF MOTOR.





COMPLETE ROTOR IS DYNAMICALLY BALANCED AFTER ASSEMBLY TO GUARANTEE SMOOTH, QUIET OPERATION.

RUGGED, CROSS-WELDED, FORMED STEEL BASE PROVIDE FIRM MOUNTING SUPPORT.

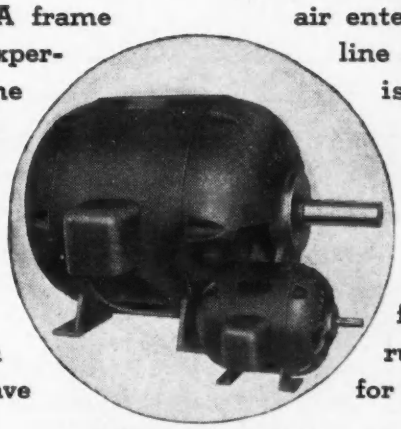
ALL VENTILATING OPENINGS ARE BELOW CENTERLINE. STURDY SHEET STEEL BAFFLE DIRECTS FLOW OF INCOMING AIR FOR MAXIMUM COOLING EFFECT.

CROSS SECTION VIEW OF BURKE TYPE NB INDUCTION MOTOR, FRAME 404

Burke Series "D" NEMA Frame Sizes 203 to 505.

Burke's new line of Drip-Proof Induction Motors follows our traditional policy of designing to generous proportions. We have achieved the utmost from NEMA frame standards utilizing over 30 years experience with welded steel plate frame construction. We have not tried to confine component parts into minimum space. As in all Burke motors we have designed for a generous factor of safety.

These Series "D" Motors on exhaustive tests in our plant have fully justified our generous-proportion-theory—they run exceptionally cool over extended periods of service. Note above that cooling air enters at each end below the centerline induced by rotor fan action, and is deflected up and down and around motor windings leaving thru large side openings between feet and below the centerline—no chance for recirculation. Here ample interior space for air-flow contributes to cool running. Write for bulletin D-1 for complete data.



Uniform in design from NEMA frame sizes 203 to 505.

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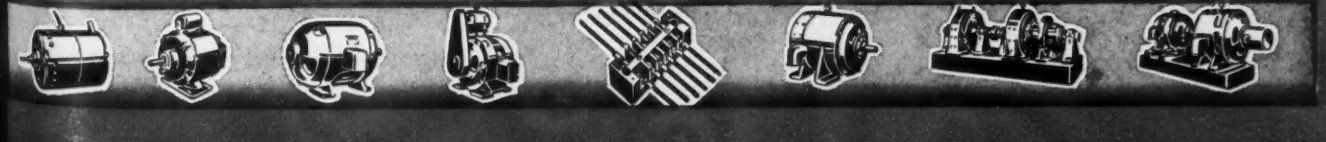
UNIVERSAL MOTORS 1 Min to 1½ HP | SINGLE PHASE MOTORS to ½ HP | INDUCTION MOTORS 1 to 1000 HP | SYNCHRONOUS MOTORS to 1000 HP GEN. to 1000 Kw. | TERMINAL BLOCKS 10 TYPES | D. C. MOTORS to 1000 HP GEN. to 1000 Kw. | M-G SETS to 1000 Kw. | HIGH CYCLE M-G SETS— 7 STD. SIZES



it. Measured on the under side, the gaff should be from $\frac{3}{32}$ to $\frac{5}{32}$ in. wide at $\frac{1}{16}$ in. back from its point.

8. After the gaff has been shaped in accordance with the above, the point of the gaff is finally shaped. This is done by rounding the under surface to the gaff, beginning $\frac{1}{16}$ in. back from the point and rounding toward the point by curving motion of the file. This is the only portion of the under surface of the gaff which should be filed.

9. Climbers should not be used when the gaffs are less than $1\frac{1}{4}$ in. long, measured on the underside. They then should be returned to the factory for re-gaffing or replaced with a new pair.

When sharpening climbers it is well to remember that the object is to attempt to restore the gaffs to the same general form and shape they had when they left the factory.

• • •

Favorable Selenium Rectifiers

RESEARCH DATA which enabled German manufacturers to produce highly efficient selenium rectifiers at low costs are contained in a report now on sale by the Office of Technical Services, Department of Commerce. The report was prepared by Dr. Todos M. Odarenko and the major part consists of a translation of a German document describing the results of X-ray analyses of selenium rectifier plates at various stages of manufacture.

The studies conclusively established the following facts:—

1. The interaction between the selenium layer and the base plate metal (or metal deposited on the plate) produces a transitional barrier that controls the ratio of the forward current to the reverse current of the rectifier.

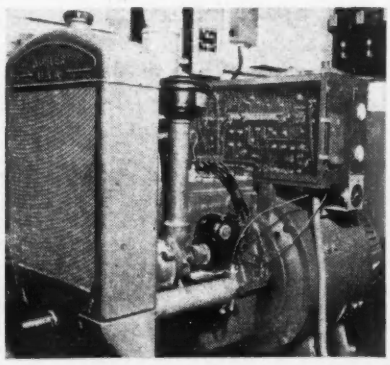
2. A definite relationship exists between the crystalline structure of the selenium layer and its forward and reverse conductivity; and, therefore, between the crystalline structure and the maximum load the rectifier can handle efficiently.

3. The manner in which the selenium is applied to the base plate, the temperature conditions during its application, the use of intermediate layers, and the addition of such elements as iodine determine the crystalline configuration of the selenium layer.

4. A great variety of cross-linking takes place between individual chains of selenium crystals. As a result, no hard and fast rules for the manufacture of selenium rectifiers can be laid down.

5. Chlorine, bromine, iodine, tellurium, sodium, and thallium speed the conversion of amorphous selenium to the crystalline state. Arsenic and phosphorus inhibit such action.

Emergency Power for Dispatching



EMERGENCY POWER supply unit for central dispatching office. In event of complete power failure this Kohler 5-kw., 115-volt, a.c. packaged power unit starts automatically to provide emergency service for the central dispatching center of Puget Sound Power & Light Co. in its Seattle office building. This operating unit of the Northwest Power Pool dare not chance power failure

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Meter Tester Switches Load And Coil Simultaneously

FIG. 1—Portable meter test unit. Rotary switch hidden by potential leads

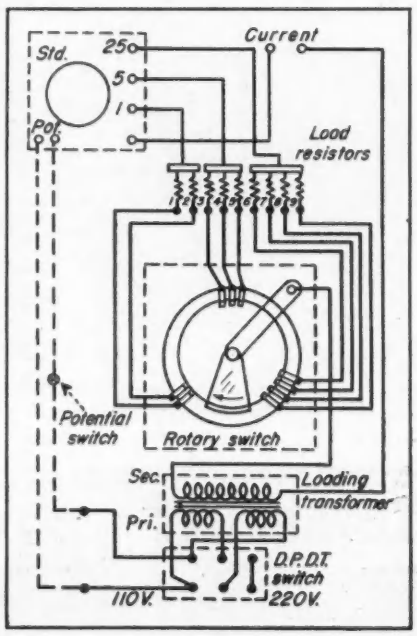

FIG. 2—Internal connections of meter tester. Resistor ratings Nos. 1 and 2, 0.5 amp. each; No. 3, 1.5 amp.; No. 4, 1 amp.; No. 5, 2.5 amp.; No. 6 and 8, 10 amp. each; No. 7, 5 amp.; No. 9, 15 amp.

A. F. STILSON
Formerly Electric Meter Foreman
Illinois Power Co.
Galesburg, Ill.

IN THE DEVELOPMENT of a meter test unit a switching arrangement has been incorporated to connect the proper standard coil at the same time the phantom load is changed. The portable unit (Fig. 1) is used to test ordinary watthour meters and demand meters, and major component parts include an IB-10 standard, built-in phantom load, rotary switch, loading transformer and double-pole double-throw switch. It was designed and built by C. W. Willits, journeyman meter testman with the Illinois Power Co. at Galesburg, Ill.

Carrying case is made of $\frac{1}{8}$-in.

"Our engines have made an outstanding operating record with Gulf Parvis Oil" says this Chief Engineer

The "Ductillite," operated by the Wheeling Steel Corporation, which every year hauls one of the largest tonnages on the Ohio River. (Below) the Chief Engineer (right) gives a Gulf Lubrication Engineer (left) some facts on the fine performance of Gulf Parvis Oil.

"GULF Parvis Oil has been used exclusively in her engines since she was commissioned in October, 1940," says the Chief Engineer of the 'Ductillite,' "and they have made an outstanding operating record, with very low maintenance costs."

This boat is powered by two 380 H.P. four-cycle Diesels. The piston rings and cylinder walls of these engines are lubricated by oil mist and oil splash thrown by rotation of the crankshaft. Here, as in other Diesels using similar lubricating systems, Gulf Parvis Oil's greater resistance to oxidation minimizes the formation of harmful sludge which often results when oil and air are in intimate contact at high temperatures.

For maximum efficiency and lowest maintenance costs for your Diesels, call in a Gulf Lubrication Engineer and ask him to recommend the proper grade of Gulf Parvis Oil to meet your particular requirements. Write, wire, or phone your nearest Gulf office today.

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For years *Permazinc* on Locke suspension and switch insulators has been a standard of comparison to operating men. Get this same dependability in pole line hardware by specifying Locke.

The ***Permazinc*** process is more fully described and illustrated in a folder recently issued. Get your copy by addressing a card or letter to Locke Insulator Corporation, Advertising Division, P. O. Box 57, Baltimore 3, Maryland.

Locke POLE LINE HARDWARE and INSULATORS

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prestwood and has a 2-in. deep removable cover. Over-all dimensions are: 12 in. long, 6½ in. wide, 8½ in. deep. Weight of case and equipment is approximately 21 lb.

Internal connections are shown in Fig. 2. The loading transformer is a 35-amp., 110/220-volt set of coils removed from an old phantom load. The rotary switch is built up of ⅛-in. bakelite, a few radio parts, such as knob and binding posts, and current contact points from an old phantom load. The load resistors are protected by a shield of perforated metal. The size of the resistors was arrived at by "cut and try" method. The bank of resistors is divided into three sections, one each for 1-, 10- and 25-amp. coils of the standard. They are cumulative for each section and coil. A double-pole double-throw switch changes the loading transformer primary from 110 to 220 volts and vice versa.

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Cable-Overhead Tie With Simple Design

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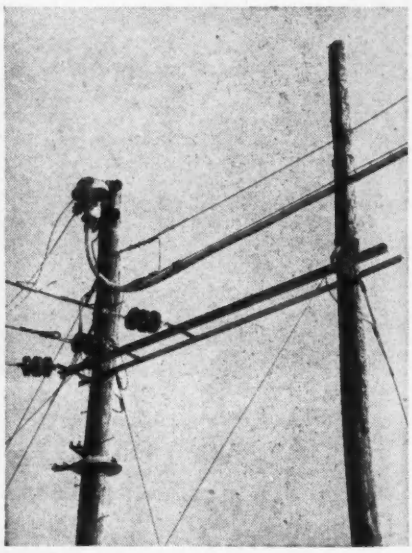

CABLE CIRCUIT terminated in three-phase pothead. Short overhead span links terminal pole with adjacent transformer yard

ON AN EASTERN utility system a 23-kv. circuit connecting a major generating plant with a suburban substation having step-up transformers feeding a 66-kv. line terminates just outside the switchyard in a three-phase cable from which overhead connection is made to the substation from a pothead mounted on one of two poles at the end of the cable run.

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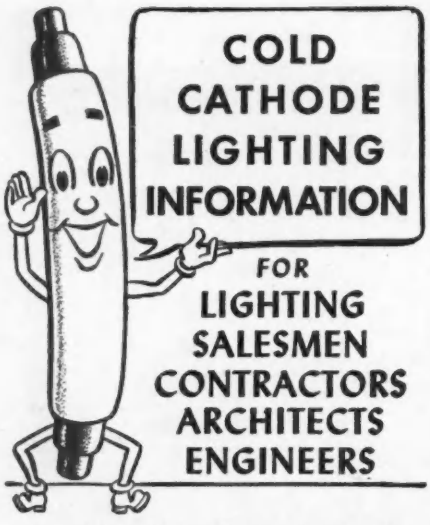

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GENERAL LUMINESCENT CORP.
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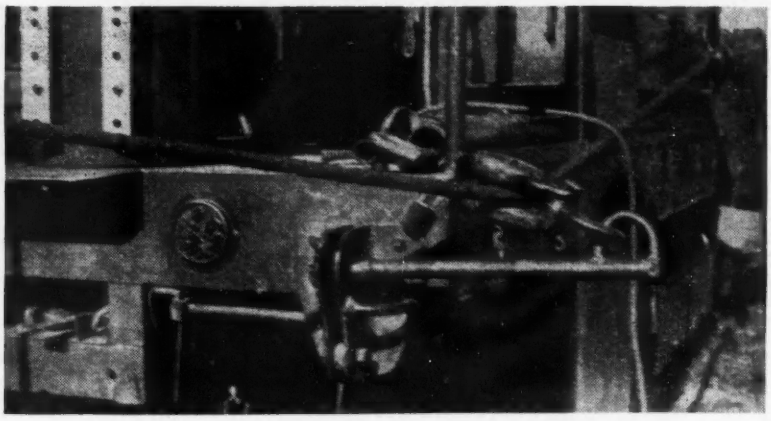
Short stub crossarms carry the pothead, from which jumpers are dropped to the phase wires of the line section extending into the yard, and the cable is supported by messenger. The section leading into the yard terminates on three-disc strain insulators attached to a pair of steel angles seated on each side of the two poles, and these angles form a mechanical tie of much value between the poles. The messenger and the pole guys are grounded together, and the right hand pole is useful mainly from the mechanical structure viewpoint. Lightning arresters and circuit breakers were installed within the substation yard, leaving the two-pole cable terminal layout as simple as appeared feasible. Only one set of insulators was required in the cable terminal and overhead feed.

Snatch Block Holder

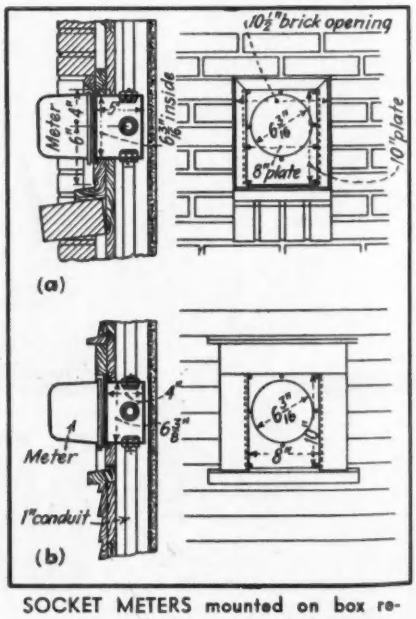


THE OUTRIGGER shown permits an extra snatch block to be placed at rear of truck to keep the fall line feeding straight onto nigger head where it is inconvenient or impossible to position truck for a straight pull. The 1⅛-in. steel bar shown has an eye in one end for the block, the other being fitted with a collar so that it can be held in the socket that supports the derrick, or a separate socket may be provided especially for the purpose. For pulls opposite that shown, the snatch block is hooked into the welded-in curved bar shown directly beneath the extension eye first described. The idea was that of Charles Kesterson of Pacific Gas and Electric Co.'s San Jose (Calif.) division and has been found especially convenient in raising transformers

Outdoor Meters Recessed in Wall

C. W. MINARD
Chief Engineer
Omaha Public Power District
Omaha, Neb.

IMPROVEMENT in the appearance of service entrances and outdoor socket meters may often justify having them recessed into the building wall. This is one of the suggested methods provided in Omaha, and adapter boxes are available to builders for framing into residence walls. The accompanying sketches show installation of the two box sizes which are used for brick and for wood construction. The service conduit is terminated in the box and the meter ring fits on the open face of the box.



SOCKET METERS mounted on box recessed in wall allows concealed entrance conduit on (a) brick veneer building and on (b) wood or stucco building

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3. Maul with seasoned hickory inserts to prevent damage when driving anchor rods.

4. Trip auger—bores like a bit, telescoping rod from 5 to 8 feet, adjustable reamer for various hole sizes, easy dump trip.

5. Anchor expanding and tamping bar. Hooks around rod to prevent slipping off anchor top plate.

6. Transformer gin with new light weight aluminum fitted chain tightener. Easy to apply. Has safety lock.

7. Tugger pulls or lifts in any position. Link type chain prevents binding or kinking. Light weight diecast aluminum alloy handle, housing and cover.

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Combating Storage Tank Corrosion

From an article by Jerome M. Bialosky in "The Frontier," Armour Research Foundation, Chicago, June, 1946.

PROTECTION of domestic hot water storage tanks against corrosion is ordinarily done with hot-dip galvanizing. Nonferrous metals, such as monel, are satisfactory but cost about five times as much as galvanized steel. With carbonate waters it is necessary to coat the inner surface of the monel metal tank with tin to prevent green water.

In another method of protection of the metal from corrosion, electric current is used. The tank is made cathodic and a suitable anode is suspended in the water. Direct current is supplied from a rectifier. This process is being used to supply large water storage tanks, and tests with range boilers indicate that the method will protect bare steel tanks. Success with the method will require suitable material for the anodes and careful design of the anode arrangement to give uniform protection.

Lightning Discharge And Flashes

From a paper by C. E. R. Bruce and R. H. Golde (British Electrical and Allied Industries Research Association) before the Conférence Internationale des Grands Réseaux Électriques, Paris, June 27-July 6, 1946.

STUDY of available data shows that the charge neutralized in a lightning flash comprising several successive strokes is about 30 coulombs, of which 10 coulombs are neutralized in the intervening space. The average current is about 20,000 amp., and the maximum current may reach 160,000 amp. A current of a few amperes probably flows throughout the duration of a multiple flash with the high current pulses superimposed. Potential of the thundercloud is of the order of 50,000 kv., or somewhat lower than values hitherto suggested by some investigators.

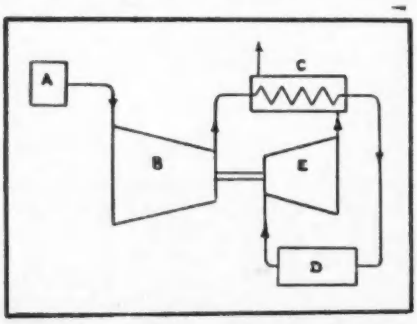
The mechanism of stroke propagation and current produced are discussed mathematically by the author, leading to figures for the attractive range of a lightning conductor. It is determined that a transmission tower may attract to itself all flashes which without it would have struck a circular ground area with radius of twice the tower height. There is good agreement of this with field observations.

Experimental Gas Turbine Tried

From an article in "The Electrician," London, July 26, 1946.

CONSTRUCTION of an experimental 500-bhp., 6,000-rpm., internal combustion turbine unit incorporating developments in heat-resisting alloys and data obtained from jet propelled airplanes has been completed by C. A. Parsons & Co., Ltd., in collaboration with the Parsons Marine Steam Turbine Co. The rating was believed the smallest from which desired information could be obtained. The plant has now been running on almost continuous tests for six months.

The operation is shown in the diagram. Air drawn into the system through the filter *A* by means of the axial compressor *B* is delivered to the regenerator *C* at about 50 psi. Here it takes up waste heat from the turbine exhaust gases before entering the combustion chamber *D*, where fuel oil is sprayed through an atomizing nozzle and burned by part of the incoming air, the remainder of the air being diverted to cool the walls before mixing with the products of combustion at the outlet. Resulting high temperature gases pass to the turbine *E*, which drives the compressor, the net available power being absorbed by a Froude dynamometer.



DIAGRAMMATIC layout of components of gas turbine unit

Speed is controlled normally by throttling the fuel supply. An emergency stop valve shuts down the set. For starting the rotor is brought to half speed by an electric motor, after which the fuel is turned on and ignited, then the motor is declutched automatically. Pumps for lubricating and fuel oil are separate, but no other auxiliaries must be started.

Blackburn Station Extended

From an article in "Electrical Review," London, April 26, 1946.

EXTENSIONS to the power station of the Blackburn (England) Corporation Electricity Undertaking, formerly rated at 25,000 kw., have made it virtually a new installation. The portion just installed, with a capacity of 70,000 kw., includes a 30,000-kw., 3,000-rpm. turbo-generator with two 150,000-lb. per hr. boilers, concrete cooling tower and 33-kv. switch house, commissioned in December, 1942, and a 40,000-kw., 3,000-rpm. turbo-generator, four 150,000-lb. per hr. boilers and cooling tower put in service in December, 1945. The total cost was about £2,000,000 ($8,000,000).

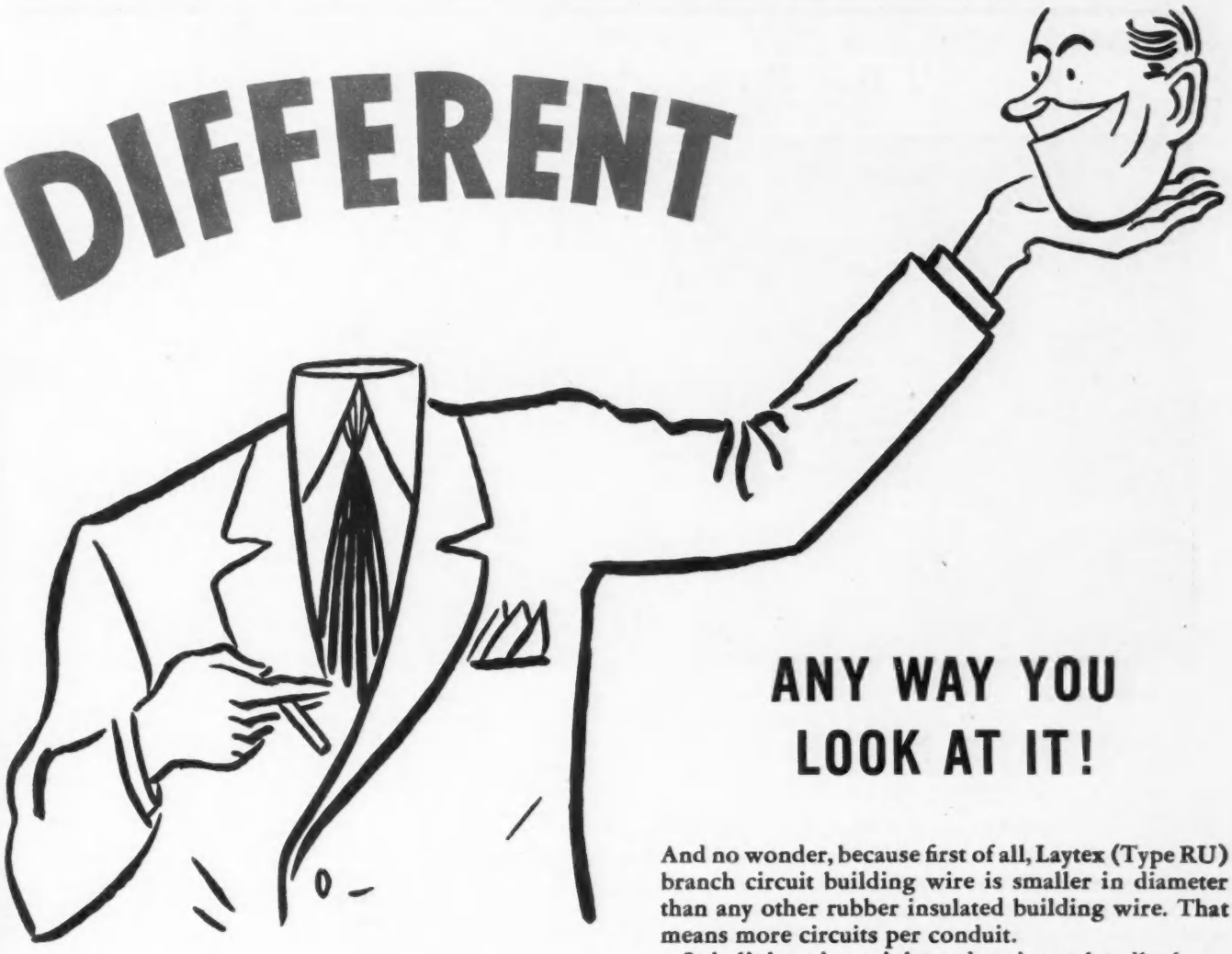
Outstanding features are full automatic control of the stoker-fired boilers, with separate boiler control room, direct generation at 33 kv., and a central 250-ft. chimney for all six boilers, which are rated at 630 psi. and 875 deg. F.

Both generating sets are English Electric Co. make. In the 40,000-kw. set there are 19 fixed and 19 moving stages in the high-pressure impulse cylinder and 11 moving stages in each of the two low-pressure cylinders. Steam consumption is 366,000 lb. per hr. at full load.

UNITED STATES RUBBER COMPANY

SERVING THROUGH SCIENCE

DIFFERENT



ANY WAY YOU LOOK AT IT!

And no wonder, because first of all, Laytex (Type RU) branch circuit building wire is smaller in diameter than any other rubber insulated building wire. That means more circuits per conduit.

It is lighter in weight and easier to handle, has a saturated cotton fibrous cover that is flame-retardant and moisture-resistant.

Laytex (Type RU) is insulated with laminated walls of 90% unmilled, grainless natural rubber. This forms a homogeneous sheath around perfectly centered conductors, eliminating the possibilities of thin spots.

In physical and electrical properties, *Laytex has no equal.*

RU wiring with RU?

Small diameter. Light weight. Natural rubber insulation. Perfectly centered conductors. High tensile strength. High dielectric strength. Flame retardant, moisture resistant cover.

UNITED STATES RUBBER COMPANY

1230 Avenue of the Americas • Rockefeller Center • New York 20, N.Y.

U.S. LAYTEX — THE FINEST BUILDING WIRE ON THE MARKET

U.S. Laytex

Reg. U. S. Trade Mark

ELECTRICAL WIRES AND CABLES

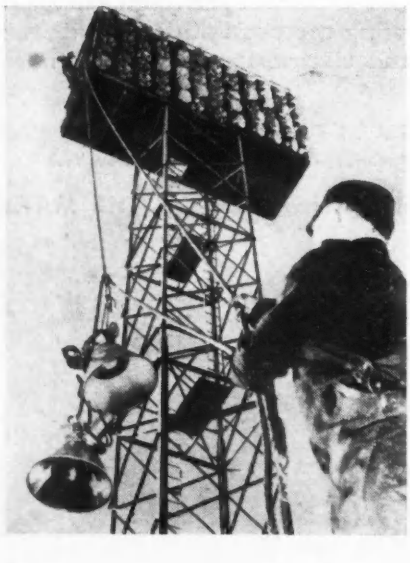
LOAD BUILDING

Ball Park Lighting Modernized

NIGHT VIEW of relighted Seals Stadium in San Francisco (left), taken during the Seals vs. New York Giants game, first of the 1947 season. Intensity is 60 foot-candles on the infield and 40 foot-candles in the outfield as compared with a maximum of 25 foot-candles anywhere on the field with the old 1931 lighting . . . Narrow beam floodlights at Seals Stadium were adjusted in daytime by laying field out in 20-ft. squares (right) and aiming one light at marker in each square. 1,500-watt lamps in L69 reflectors burn at 10 percent overvoltage to provide 33 percent more light with 16 percent greater wattage

AS A LOADBUILDER in the lighting field, modernization of sports lighting now offers excellent opportunities. With the specially designed equipment presently available the illuminating engineering profession has an effective new tool with which to work. Relighting of three Pacific Coast Baseball League parks are examples of what can be done. Latest of these is Seals Stadium in San Francisco, a $50,000 job, where load has been increased from 308 kw. to 534 kw. Illumination on the field was increased from a maximum of 25 foot-candles (down to five in spots) to a minimum of 40 foot-candles in the outfield and ranging up to 60 foot-candles on the infield with the new lighting.

SPORTS FLOODLIGHTS atop 125-ft. towers light San Francisco ball park to 60 foot-candles



The old installation, made in 1931, consisted of 308 1,000-watt floodlights mounted in banks on six 125-ft. latticed steel towers. In their place has been installed 303 L69, General Electric sports floodlights. These are equipped with 1,500-watt lamps burned at 10 percent overvoltage to provide 33 percent more light with a 16 percent increase in wattage, or 1,740 watts. Under overvoltage burning, life of the nominally rated 1,500-hr. lamps will be approximately 500 hr. This is ample to cover one season's use, the intent being to replace all lamps each season.

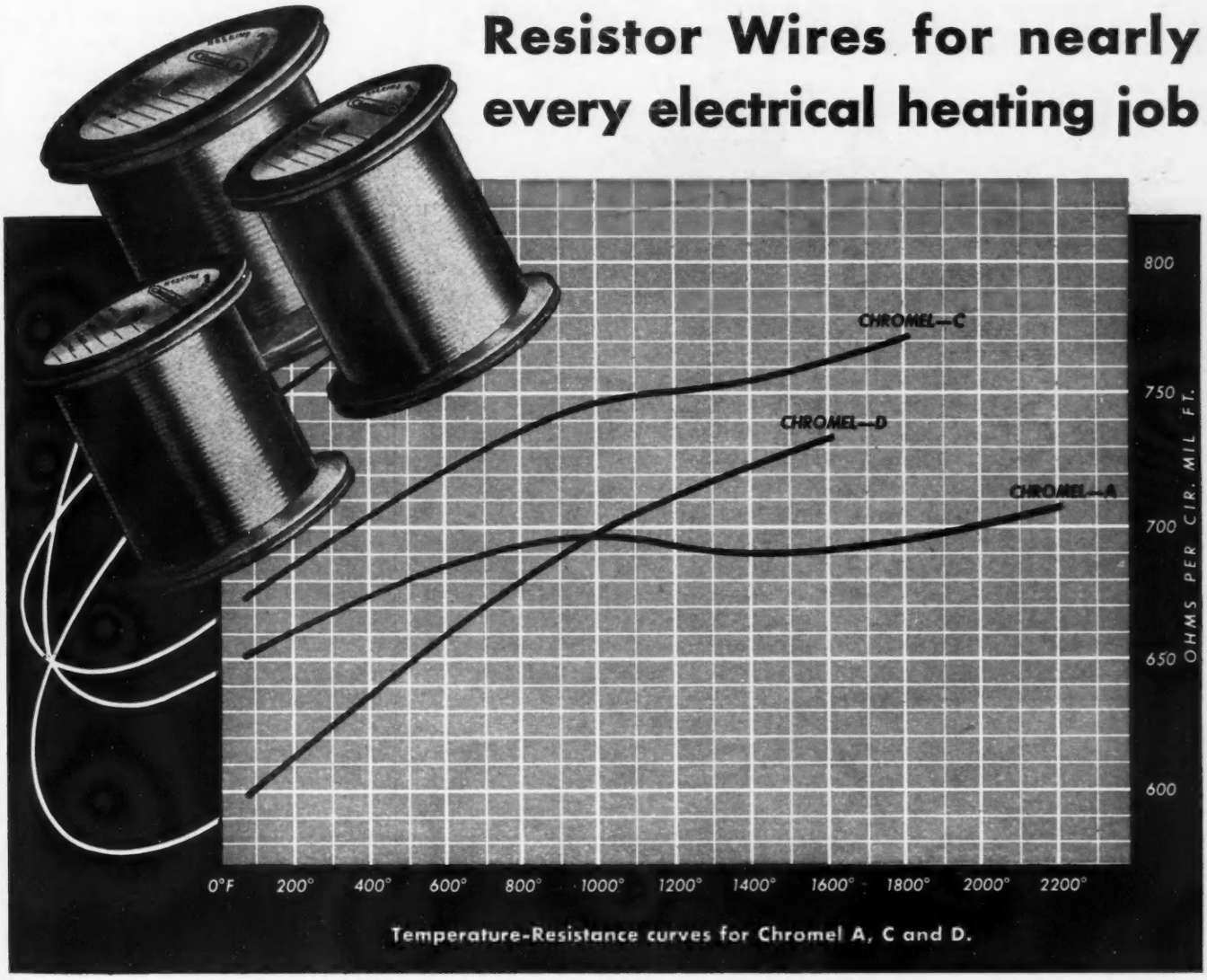
The new projectors are an improved version of the narrow beam type first used in relighting Yankee Stadium in 1945. Three beam widths are used, 20, 36 and 72 deg. The narrow beams are for the long throws and the wide beams for close-up areas around the diamond and in the outfield.

The new concept of sports lighting is to throw high-intensity spots on the field and so to aim the beams that a uniform lighting pattern is obtained. To do this a new technique in adjusting the lights is used. The field is laid out in 20-ft. squares as illustrated and the beam of each lamp is adjusted to strike the center of one square. This saves a great deal of time, results in more uniform lighting and, very importantly, makes possible adjusting the lights during the daytime, all but the finishing touches.

Of the eight fields in the Coast

CHROMEL*

Resistor Wires for nearly every electrical heating job



Temperature-Resistance curves for Chromel A, C and D.

DURABLE CHROMEL Resistor Wire is "hot stuff" for countless electrical heating applications . . . for ranges, roasters, ironers, toasters . . . laboratory, brazing and heat-treat furnaces. A smooth wire . . . of uniform resistance, it's produced in three grades and a wide range of sizes to meet the requirements of nearly every high, medium and low temperature application.

CHROMEL-A is the nickel-chromium alloy that first made electrical heating practical. It possesses close-to-constant "hot" resistance between 700° and 2000°F. and it delivers full rated power throughout its long and useful life. Resistivity: 650 ohms per circular mil foot at 68°F.

CHROMEL-C is for milder applications not exceeding 1700°F. It is particularly recommended for developing high resistances within a small space. Resistivity: 675 ohms per circular mil foot at 68°F.

CHROMEL-D is suited to the many lower temperature applications around 1200° to 1400°F. Resistivity: 600 ohms per circular mil foot at 68°F.

Our Catalog-M1 is devoted exclusively to helpful technical information on the CHROMEL Alloys and their application. Want a reference copy?

Chromel
NICKEL CHROMIUM WIRE

*Trade Mark Reg. U.S. Pat. Off.

HOSKINS MANUFACTURING COMPANY • Detroit 8, Michigan

53% More Fire-Fighting Power

with the NEW Ansul-Dugas Dry Chemical Fire Extinguisher

Engineered to provide 53% more and faster fire-stopping power, the NEW Ansul-Dugas Fire Extinguisher is ready to use—IN A FLASH—on Class B and C fires. The wide heat-shielding stream of Ansul Plus-Fifty Dry Chemical from the specially designed nozzle makes extinguishing more certain even by inexperienced employees.

STOP FIRE FASTER!

HERE ARE OTHER PLUS FEATURES

- Quicker, easier, on-the-spot recharge right after use.
- Highest Rating for SPEED and EFFECTIVENESS as determined by impartial authority.*
- New, wider coverage type nozzle with long range effectiveness.
- Greater fire-fighting power pound for pound, dollar for dollar.
- Increased fire-fighting capacity without increased weight.
- Engineered to resist corrosion.
- Ansul Plus-Fifty Dry Chemical is nontoxic, non-abrasive, non-corrosive.

*Write for charts based on authoritative data of comparative ratings as determined by a national approval agency.

ANSUL CHEMICAL COMPANY
FIRE EXTINGUISHER DIVISION, MARINETTE, WISCONSIN

League, the other two to have been modernized are Sacramento and Oakland. Portland Meadows race track in Portland is a recent new installation with L69 lamps. Modernization of lighting in the famed Los Angeles Coliseum, now under way, also will use narrow beam high-intensity spots.

•

St. Louis Shows Restaurant Equipment

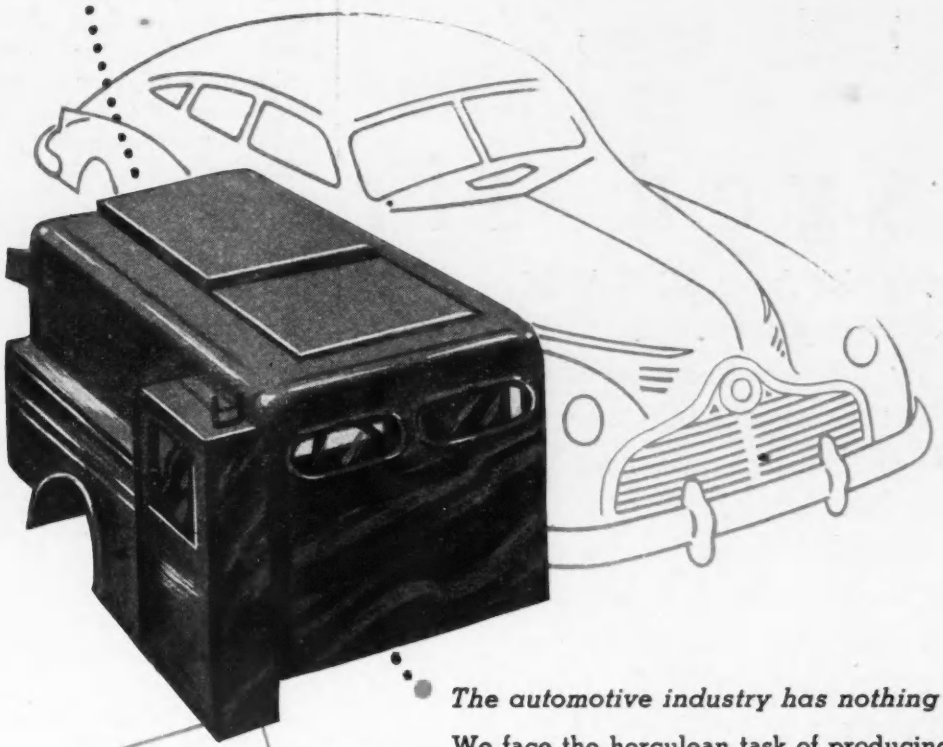
ROBERT A. LATIMER
St. Louis, Mo.

THE "SALVAJOR," a machine for prerinsing dishes before they go into the washer, is demonstrated at Union Electric's restaurant show

A RECORD SALES volume of electrical dishwashing equipment, booster water heaters, immersion heaters and sanitizing equipment was the result of an electrical restaurant show held by Union Electric Co., St. Louis, from March 3 to 7.

The show, first all inclusive exhibition of electric cooking and other food service equipment ever staged in St. Louis, was built around the new St. Louis restaurant sanitation ordinance, which has set stiff minimums on which all food service establishments are judged. All hotels, clubs, restaurants, cafeterias, cocktail lounges serving food, drugstores and institutions are being inspected by 30 Division of Health inspectors, and are graded A, B, or C, according to compliance with the regulations imposed by the ordinance. Those which receive a C rating, indicating negli-

THERE'S A *Great Backlog* ON TRUCK BODIES, TOO



Our body production highest in history, but deliveries slow due to unprecedented demand

The automotive industry has nothing on us.

We face the herculean task of producing several times the normal production of American bodies in one year.

Everything that can be done has been done. Facilities have been increased . . . production lines revamped . . . new machines and personnel added. As a result, we are producing more bodies than any time in our 42-year history. Production figures keep going up and up and up.

But this mathematical equation will require several months of record production before we can give definite delivery promises.

ACB and

THE *American* COACH and BODY COMPANY

9503 WOODLAND AVE., CLEVELAND 4, OHIO

SALES and ASSEMBLY THE AMERICAN COACH AND BODY CO OF CALIF . 432 FIFTH ST . OAKLAND 7, CALIF.
BAKER EQUIPMENT ENGINEERING CO . SUMMIT & NORFOLK STS . RICHMOND 11, VA.

OFFICES 350 MADISON AVE NEW YORK 17, N. Y. INSURANCE EXCHANGE BLDG . DES MOINES 9, IOWA

packaged air

is more than a pipe dream. SCHRAMM COMPRESSORS, for example, package air every day for industrial consumption. The selection of SCHRAMM AIR COMPRESSORS is influenced by features that include: (1) 100% water cooled; (2) forced feed lubrication; (3) mechanical intake valve; (4) compact, lightweight. Designed for heavy duty, continuous service and minimum attention. There's a SCHRAMM AIR COMPRESSOR for your every need, in sizes ranging from 2 to 600 cubic feet displacement.

SCHRAMM
INC.
THE COMPRESSOR PEOPLE
WEST CHESTER, PENNSYLVANIA

gence or improper maintenance, will be given thirty days to improve their operating methods or will lose their licenses.

Finding that the chief reasons for C ratings in the early stages of the citywide inspection were improper dishwashing, poor care of electrical equipment and insufficient equipment, Union Electric Co.'s commercial sales department took the opportunity to bring all parties concerned together. Leading food service equipment manufacturers, lighting fixture manufacturers, refrigeration distributors and air conditioning dealers were invited to use Union Electric's first floor for a comprehensive, instructive exhibit of their products, while George Reeves, chief of the food control section of the Division of Health, was likewise invited to address panels of food service operators in the building auditorium.

Diversified Program

Mr. Reeves addressed five groups of food service operators during the show, totaling some 1,700. The exhibits on the first floor were designed to clear up the sanitation problems of each type of operator. Each panel was conducted open-forum style; following a color movie on proper dishwashing which emphasized correct use of the electric dishwasher, glasswasher, water heaters, etc., Union Electric stressed the fact that insufficient amounts of hot water were responsible for the low-grading of many restaurants, and recommended immersion heaters to provide 180-degree rinse water in open-type dishwashing sinks, and electric boosters for the same temperature rinse water in automatic dishwashers. Other electrical equipment emphasized included prewasher pump-powered units, germicidal lamps, rotating brushes for glass washing, etc.

Merely adding additional electric water heating equipment or boosters solved the problems of many restaurants otherwise faced with installing new sinks or machines, according to Mr. Reeves. Where dishwashing was not the problem, the lecturer urged scheduled cleaning programs for refrigerators, ranges, mixers and other electrical equipment, food storage in stainless steel pots rather than No. 10 cans, etc.

The first floor exhibits included dishwasher setups complete, cooking

Full Capacity Always . . . No Low Cells

In control batteries the name ***Floté*** *stands for the improved construction expressly developed by Philco engineers for full float service. The advantages of this modern construction are many: measurably lower operating cost, less maintenance, longer battery life—***and of utmost importance, the elimination of low cells!**

Philco Floté Batteries are available in all types for the special needs of utility engineers. Write for specification data.

PHILCO

STORAGE BATTERIES

PHILCO CORPORATION • STORAGE BATTERY DIVISION • TRENTON 7, NEW JERSEY

BERMICO*
FIBRE CONDUIT

FOR SUREST CABLE PROTECTION - - - SPECIFY BERMICO CONDUIT

1 **LIGHT.** Easily handled on the job; one man can carry several 8-foot lengths at once—lay more per working hour.

2 **TIGHT.** All joints are precision milled for tight, speedy, installations.

3 **STRONG.** Bermico Conduit is engineered to take the shocks and stresses of transport . . . the heavy loads imposed during installation.

4 **NO SPLIT COUPLINGS.** With Bermico's specially designed couplings, you end the expense—the loss of time required to replace broken couplings.

5 **WATER PROOF.** Bermico's water absorption factor is extremely low—its insulation factor extremely high, even under toughest conditions.

6 **ACID RESISTANT.** Resistant to soil acids and alkalies, Bermico Conduit is, itself, chemically inert.

7 **SMOOTH INSIDE BORE.** Quick and easy cable "pull throughs"—without danger of abrasions—when you're using Bermico *inspected* conduit!

8 **UNIFORM.** Four rigid factory inspections guarantee Bermico's uniformity of dimensions, specifications and quality.

distributed by
WESTINGHOUSE ELECTRIC SUPPLY COMPANY
Offices in all leading cities

*Reg. Trade Mark

BERMICO FIBRE CONDUIT—A PRODUCT OF BROWN COMPANY

and serving equipment, lighting fixtures, air-conditioning and refrigeration equipment by nationally known manufacturers, and were crowded during the entire exhibit time. Sales offices reported a long list of orders, chiefly for new water heating, dishwashing and glasswashing equipment, as a direct result of the timely electrical restaurant show.

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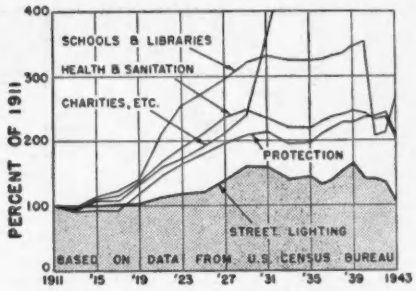
Can't Afford Not to Spend More for Street Lighting



TRENDS of municipal expenses show street lighting costs have not increased nearly as much as others

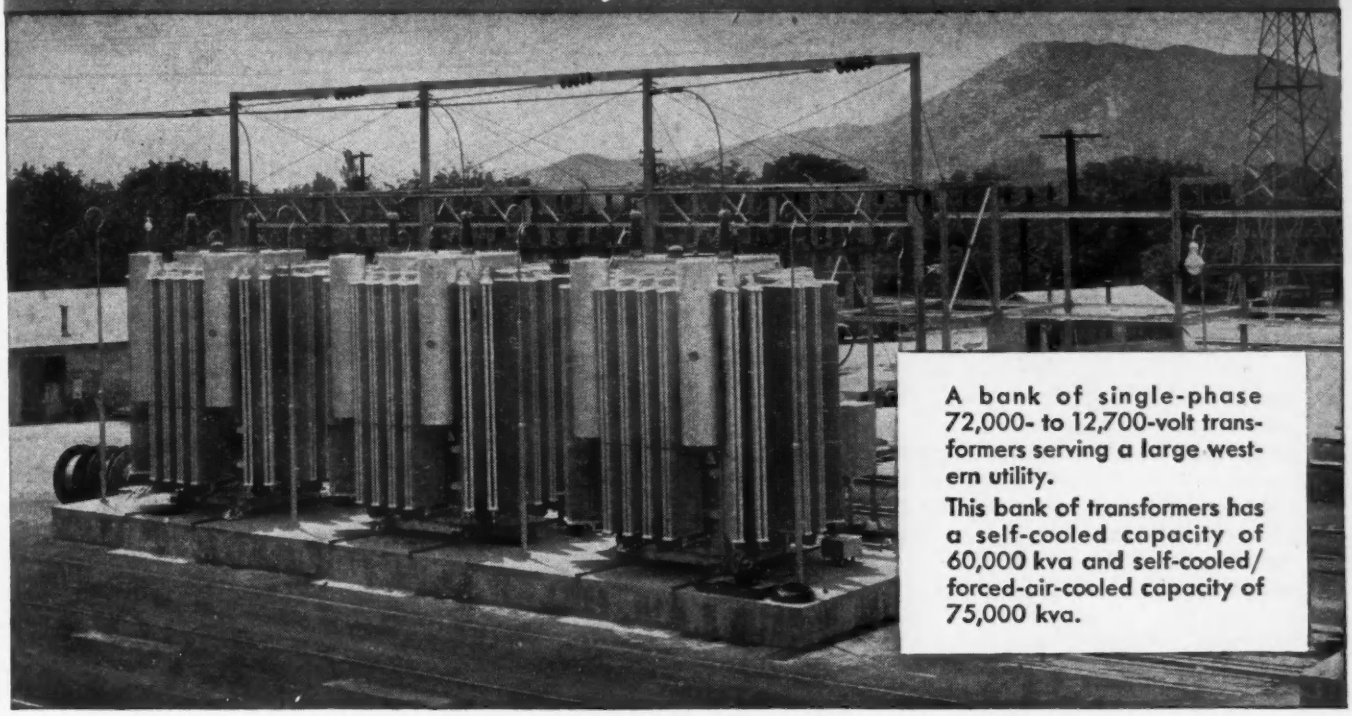
On an average, less than 2 percent of the municipal tax dollar is now spent for street lighting, said A. F. Dickerson, manager, lighting division, General Electric Co. at a recent meeting of the Southeastern Electric Exchange. The percentage is much higher in many small towns and villages but the average is brought down by the comparatively small expenditures of the larger cities.

Costs Remain Stable

While other expenses of municipal operation have gone up two or three or more times, as shown on the accompanying graph, cost of street lighting is practically the same today as it was over 30 years ago.

In those 30 years traffic deaths have multiplied 20 times and from the fairly constant ratio of deaths per 1,000 automobiles, 1.25 in 1930, 1.34 in 1936, and 1.23 in 1941, they can be expected to increase unless corrective measures are taken. And as has been abundantly proven by the record, adequate street and highway lighting is one of the most effective ways of improving traffic safety. Municipalities can afford, can't afford not, to spend a great deal more for street lighting.

They ask no favors . . .



A bank of single-phase 72,000- to 12,700-volt transformers serving a large western utility.

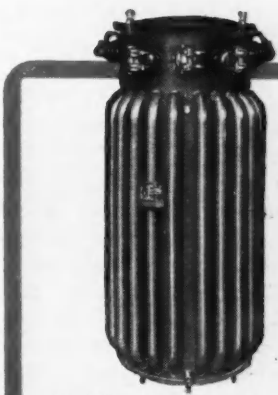
This bank of transformers has a self-cooled capacity of 60,000 kva and self-cooled/forced-air-cooled capacity of 75,000 kva.

WAGNER Transformers Give Many Years of Dependable Low-cost Service . . .

Embodying the latest improvements in design and construction . . . executed with the same painstaking care that has made the name Wagner synonymous with quality for more than half a century, Wagner Power Transformers ask no favors. They have the stamina to stay right in there pitching . . . furnishing years of dependable, low-cost service.

Wagner engineers know that each and every power transformer must meet predetermined specifications. Various parts and the method of fabricating them are standardized, but the final assemblies must do more than just meet the individual customer's requirement—they must test to meet rigid Wagner specifications . . . specifications that provide added safety . . . added economy . . . added service . . . far above that required by the customer.

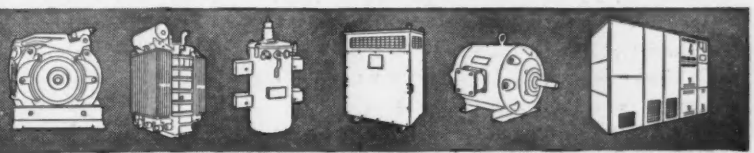
Any of our twenty-nine branch offices, located in principal cities, is ready to help you. These offices are manned by trained field engineers who will gladly give you the information you need in completing your next transformer installation. Write for Bulletins TU-180 and TU-181 on the complete transformer line. Address Wagner Electric Corp., 6456 Plymouth Avenue, St. Louis 14, Mo.



In addition to power transformers Wagner can furnish Rural Line, Distribution and Substation Transformers—all sizes and types.

Consult Wagner Engineers on All Transformer Problems

Wagner Electric Corporation
EST. 1891



T47-15

BRIDGE BRAKES • POWER AND DISTRIBUTION TRANSFORMERS • MOTORS • UNIT SUBSTATIONS

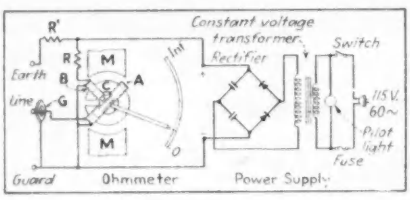
ELECTRICAL AND AUTOMOTIVE PRODUCTS

NEW EQUIPMENT

Plug-In Insulation Tester Developed by Long-Time Tests

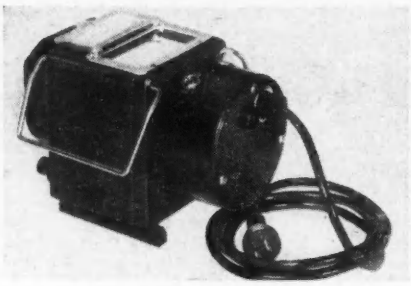
A POWER-DRIVEN Megger Insulation Tester, designed especially for insulation absorption and other long time tests, has been developed by James G. Biddle Co., 1211 Arch St., Philadelphia 7, Pa. The rectifier-operated instrument, designed to operate on a 115-volt, 60-cycle circuit, is essentially a modification of the company's "Meg" type insulation tester.

The hand generator is replaced with a power pack consisting of a constant-potential, step-up transformer and selenium rectifier giving a constant d.c. voltage, the company reports. A schematic diagram of the instrument



shows the power supply and ohmmeter hook-up. The instrument is available in ratings up to 2,000 megohms and 1,000 volts and is stated to be independent of the applied voltage.

A switch, pilot light and connecting



cable are included with the instrument. Also available as extras are a discharge switch and an ohm scale. The discharge switch is used immediately preceding and following tests on large equipment, long cables, etc., to dissipate the charge that is accumulated from the d.c. test. The switch has two positions marked Test and Discharge. The ohm scale has a range from 0 to 10,000 ohms and is in addition to the regular megohm scale. The instrument is described in Bulletin 21-46-9.

• • •

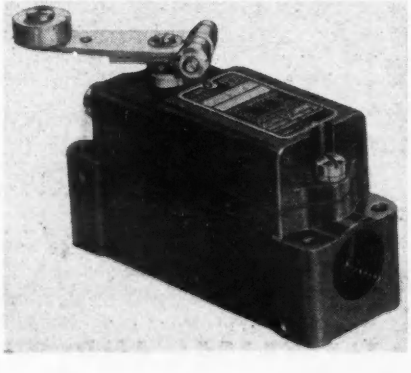
Limit Switch Enclosed For Machine Tool Application

A NEW machine tool limit switch with a self-contained contact mechanism mounted in a gasketed die-cast enclosure has been announced by Square D Co., 4041 North Richards St., Milwaukee 12, Wis. This feature is said to make possible a switch with a high electrical rating, a long mechanical life with a minimum size.

Both surface and mounting arrangements are available with either roller-arm or push-rod-operated mechanisms. The die-cast enclosure with Corporene gasket is stated to be oil and dust-tight and to be mountable in several positions. The ½-in. conduit entrance can be made available at either end of the box by rotating the cover and switch assembly 180 degrees.

Roller arm types operate with 5 degrees of travel, are provided with up to 25 degrees overtravel in either direction, and can be adjusted to any position around a complete circle. Return springs may be reversed for either clockwise or counter-clockwise motion of lever, or may be removed for maintained contact action.

Operating arms are available in various lengths from ⅞ to 3 in., rollers ⅝ in. in diameter and ¼ in. wide. The push-rod mechanism is designed for straight line operation and is not recommended for side thrusts.

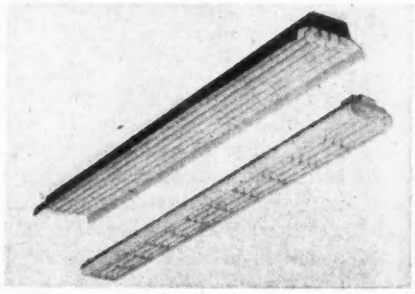


Slimline Fixtures Produce Direct-Indirect Effect

A NEW LINE of fluorescent fixtures using slimline tubes has been introduced by Leader Electric Co., 6127 Broadway, Chicago 40, Ill. The units will be known as the New Horizon series and are made in industrial and commercial fixtures, as illustrated, and in a new Slimline Trofferlite which is not illustrated.

Units accommodate four 96T8 lamps and are equipped with two 2-lamp ballasts for 200-milliamperes operation. Commercial fixtures are designed for either surface mounting or stem suspension and have a curved individual reflector over each lamp. The reflector is removable for direct-indirect lighting effect.

Louvers and end plates are now made of metal but, in the future, will be made of plastic. The industrial unit is 96½ in. long, 13 in. wide and 7 in. deep. Same dimensions on the commercial unit are $97\frac{3}{32}$ in., $16\frac{1}{16}$ in., and $5\frac{7}{8}$ in.



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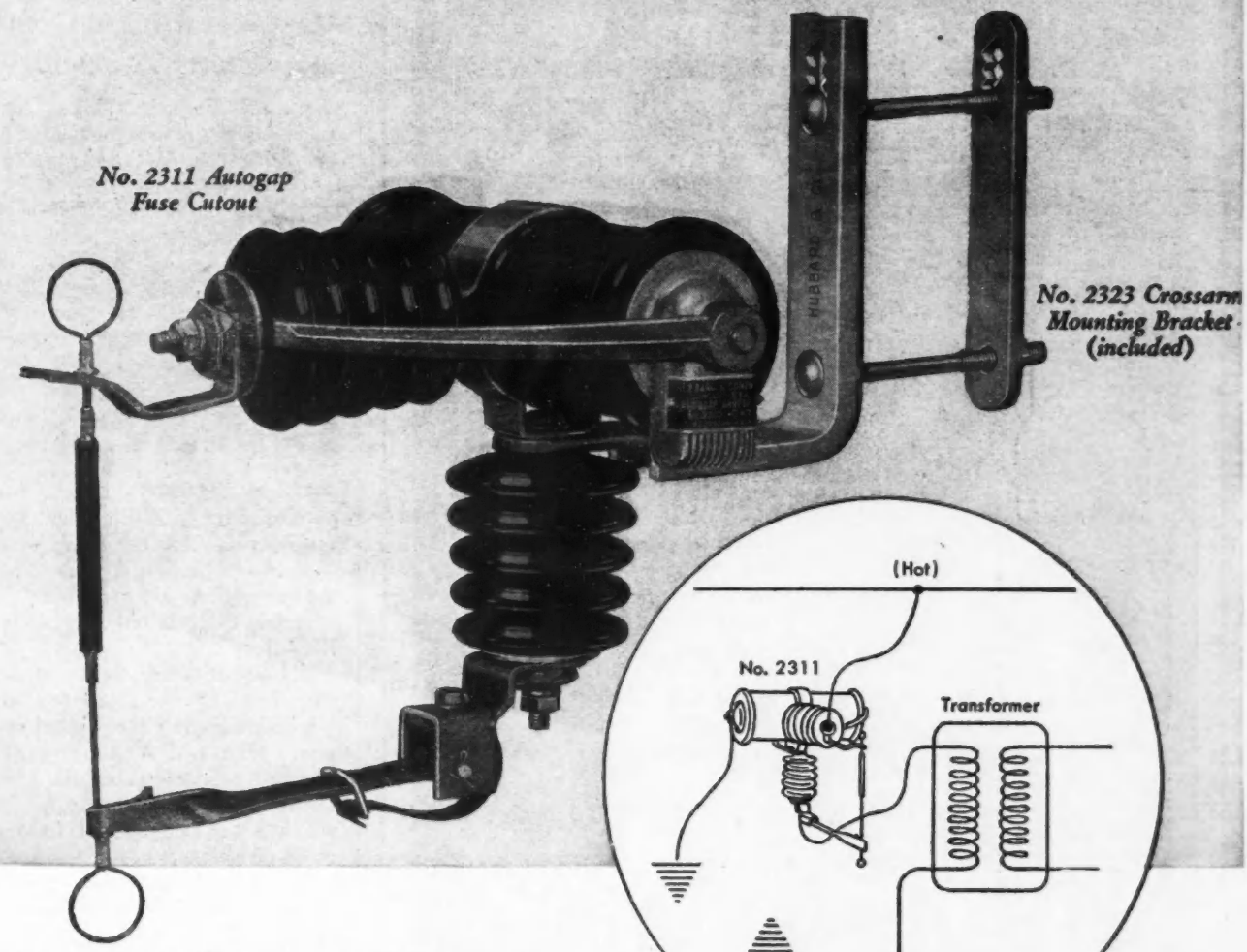
Commercial Television Set Produces 15 x 20-In. Picture

TELEVISION pictures on projection-type home receivers, two and one-half times brighter than earlier large-screen pictures, are now made possible by a newly developed screen, it was revealed recently by the RCA Victor Division, Radio Corp. of America, Camden, N. J. This screen will be employed in the company's projection television receivers which are scheduled for commercial distribution this year. The large pictures of greater brilliance provided by this screen are expected to extend television's usefulness in public places, schools and auditoriums, in addition to

HUBBARD AUTOGAP FUSE

A combination of the No. 2302 Hubbard Autogap Arrester with a 7½ K.V. dropout Fuse



Hubbard No. 2311 Style, Autogap Fuse Cutouts are recommended for use when phase to ground voltage does not exceed 7500 volts. Fuse rating is 50 Amperes and interrupting capacity is 1200 Amperes. Bracket No. 2323 is furnished for cross arm mounting and No. 2325 for pole mounting. Type of Bracket must be specified when ordering as one type only is included. Special brackets can be furnished. Fuse links are not included.

This new Hubbard open link type of cut-out is built around the sturdy and efficient Autogap No. 2302 with the fuse mechanism added. It has the same highly rated moisture proof, long-life Autogap qualifications that are so widely accepted by engineers throughout the power field. It is approved by R.E.A. and will be displayed at Hubbard Booth No. 8 at the National Rural Electric Cooperative Association Convention at Spokane, April 22-25. Ask to see it and don't miss the miniature Hubbard Autogap in action.

HUBBARD and HUBBARD COMPANY

Pittsburgh *Chicago*

Oakland, California

Highest Quality!

CRESCENT
IMPERIAL NEOPRENE
CRESCORD

For Heavy Duty
Industrial Use

The tough NEOPRENE Jacket gives this cable maximum life under the most severe operating conditions. Among its advantages, it is

OIL PROOF
SUN PROOF
ABRASION RESISTING
FLAME RETARDING
FLEXIBLE
LONG LIVED

Furnished in all sizes
from No. 18-Two Conductor
to 500,000 C. M. Three Conductor

CRESCENT
WIRE and CABLE

CRESCENT INSULATED WIRE & CABLE CO.
TRENTON, N. J.

its use in the home, the company reports.

The screen is based on a new application in plastics. Incorporated in a console type receiver, it presents a picture 15 x 20 in. in size, about the size of a standard newspaper page.

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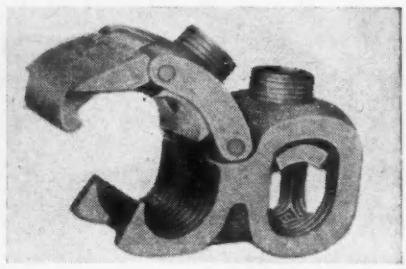
One-Piece, Hinged Connector Does Thirty-Two Jobs

A NEW one-piece, hinged connector made in 25 sizes, accommodating over 400 wire combinations ranging from



No. 8 to 1,000,000 cir mil., has been developed by O. Z. Electrical Manufacturing Co., 262 Bond St., Brooklyn, N. Y. Up to 32 different parallel or tee connections are said to be possible with one typical connector of the new XTP line.

The manufacturer reports that speed and simplicity in installation are provided by the one-piece, hinged construction. One end of the connector is snapped over the main and tightened, the other has serrated openings to which a tap can be run from any of three directions.

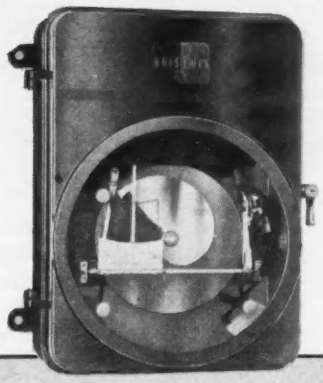
The manufacturer also reports that the body is made of a highly conductive copper alloy and the hinge and pressure plates, of high strength copper alloy. Spring-steel, tin-plated lock washers are incorporated to maintain initial pressures.

•

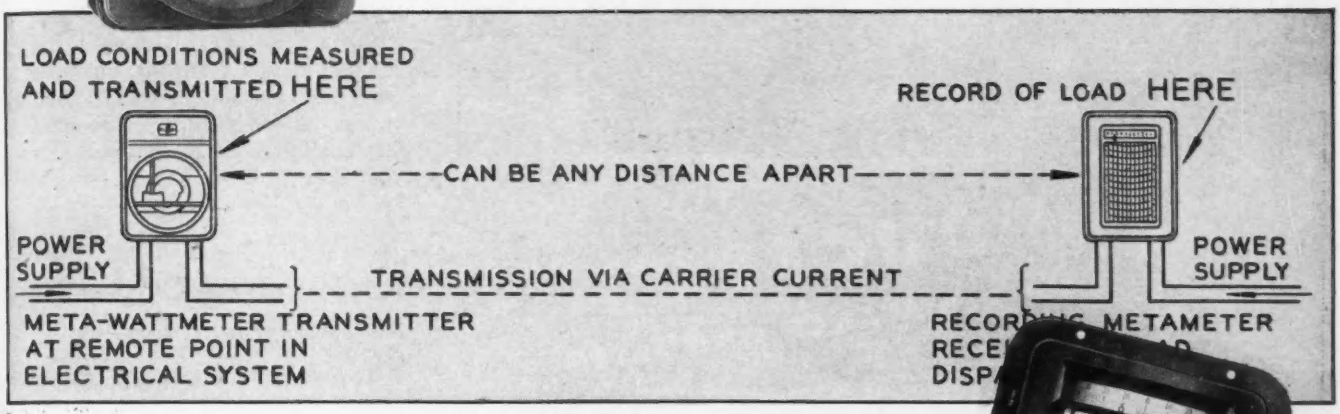
Mechanical Relay Operates Within One Millisecond

AN ULTRA high-speed d.c. relay having an operating coil and a hold-in coil has been developed by Stevens-Arnold Co.; 22 Elkins St., South Boston, Mass. Known as the Millisec relay type 162, it is assembled in a standard radio tube envelope, its operation is mechanical (not electronic), and has an operating time of one millisecond or less.

It is made in one size with single pole double throw contacts for use with resistive or capacitative loads. When use with inductive loads is contemplated, special tests are required to obtain desired life characteristics, the manufacturer reports. The addition of

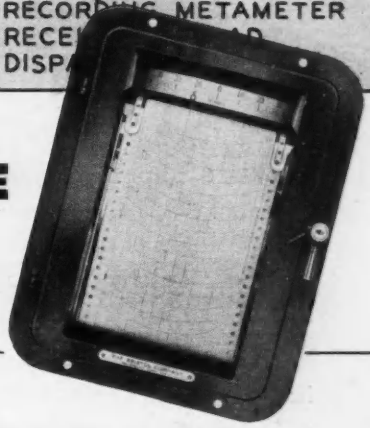


INFORMATION COLLECTED HERE . . .


LOAD CONDITIONS MEASURED AND TRANSMITTED HERE
RECORD OF LOAD HERE
CAN BE ANY DISTANCE APART
POWER SUPPLY
TRANSMISSION VIA CARRIER CURRENT
POWER SUPPLY
META-WATTMETER TRANSMITTER AT REMOTE POINT IN ELECTRICAL SYSTEM
METAMETER

ACCURATELY RECORDED HERE

Volts, Amperes, Kilowatts, Kilovolt-Amperes, Reactive KVA, Water Level, Gate Position . . . Reported Over Any Distance



Quick analysis of conditions miles away . . . permitting the system operator to act promptly and properly in cases of emergency and to anticipate and prevent abnormalities . . . is made possible by Bristol's Metameter System of Telemetering.

The Metameter operates on the impulse-duration principle, so is well suited for operation over channels commonly available on power systems, including carrier current of either unmodulated or modulated types. A carrier channel, only two metallic wires, or a circuit selected by supervising control can be used to interconnect transmitter and receiver.

Bristol's Metameter for telemetering electrical quantities is described further in Bulletin M1702. Address THE BRISTOL COMPANY, 116 Bristol Road, Waterbury 91, Conn. (The Bristol Co. of Canada, Ltd., Toronto, Ont. Bristol's Instrument Co., Ltd., London N.W.10, England).

Among uses of the Metameter are:

FOR LOAD DISPATCHER OF CENTRAL STATION SYSTEM

1. Load (active and reactive power and power demand) in each tie-line interconnecting system with neighboring system
2. Output, or total generated power, of each generating station
3. Total output of all generating stations, on a single instrument
4. Active and reactive power and power demand at key points on important transmission circuits
5. Water level and waterwheel gate position in hydro-electric plant

FOR OPERATOR OF GENERATING STATION

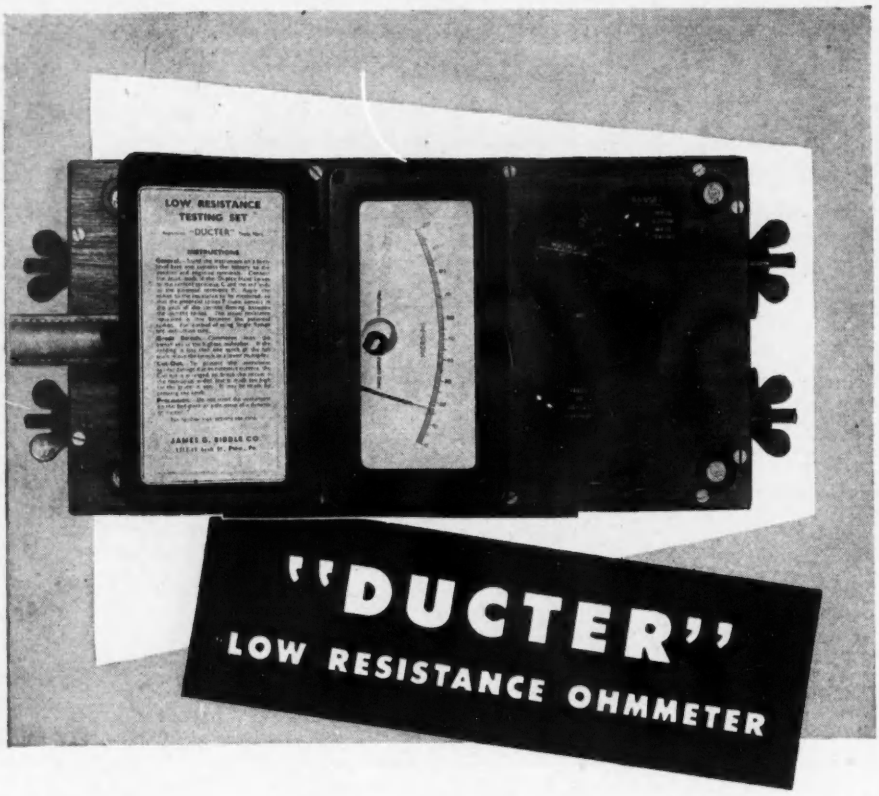
1. Total output generated in system
2. Output of each associated attended or unattended generating station in system
3. Desired output of operator's own station

FOR DISPATCHER OF DISTRIBUTION SYSTEM

1. Total kilowatt load on unattended substations
2. Bus voltage at unattended station
3. Feeder amperes

keeps you a jump ahead of demand

AUTOMATIC CONTROLLING AND RECORDING INSTRUMENTS

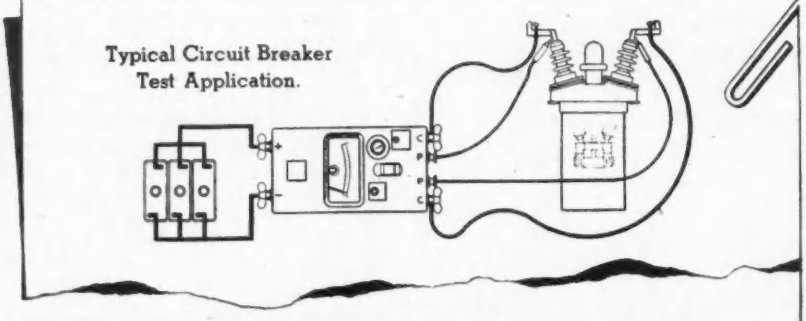


HERE'S a rugged, portable, direct-reading, and yet accurate *field* instrument for measuring resistance down to .000001 ohm (1 microhm) that can be taken right to the job and operated by *one man* simply applying a pair of hand spikes and reading the position of a pointer over a scale.

The "Ducter" Ohmmeter is invaluable for detecting trouble in switches and circuit breakers . . . for measuring any type of low electrical resistance or contact such as armature and transformer windings, soldered joints, etc.

In one operation, the "Ducter" Ohmmeter performs what otherwise requires more complicated equipment as well as both training and practice in low resistance measurement. You'll find the story of this member of the famous "Megger"* family of resistance measuring instruments in your free copy of Bulletin 24-25-W.

*REG. U. S. PAT. OFF.


Typical Circuit Breaker Test Application.

James G. BIDDLE CO.

ELECTRICAL & SCIENTIFIC INSTRUMENTS

1316 ARCH STREET • PHILADELPHIA 7, PENNA.

the hold-in coil is reported to make possible the use of the relay in photo-flash units and other applications where ultra high speed closing time is required and which is followed by a long holding-in period.

Contact rating is 110 volts d.c. at one-half ampere. The manufacturer reports life expectancy of 22,000,000 operations at one-half ampere to 100,000,000 operations at one-quarter ampere. Operating coil is wound for 3-volts, hold-in coil, 6 volts.

Series Universal Motor Made In Three Small Sizes

THE Fairchild Camera & Instrument Corp., Jamaica, N. Y., has announced a 14-oz. series universal motor for commercial, household and automotive appliances. The motor can be wound for ratings of 1/20, 1/40 and 1/70 hp. at 117 volts, and for the same ratings at 6 volts. Over-all dimensions are 3¼ in. x 2$\frac{7}{32}$ in.

The 1/20-hp. motor is rated at 4.0 inch-ounce torque at 12,700 rpm., for a 56-deg. C. temperature rise on a one-hour duty cycle. Starting torque is 15 inch-ounce, and no load speed is 20,000 rpm.

The 1/40-hp. motor is rated at 3.0 inch-ounce torque at 8,400 rpm., for a 52-deg. C. temperature rise on same duty cycle. Starting torque is 10 inch-ounce, and no load speed is 15,000 rpm., the manufacturer reports.

The 1/70-hp. motor is rated at 2.5 inch-ounce torque at 5,800 rpm., for a 40-deg. C. temperature rise. Starting torque for the smallest of the three sizes is 5 inch-ounce, and no load speed is 10,000 rpm.

Potential Actuated Relay Used on Capacitor Motor

A NEW RELAY for use with single phase capacitor motors on oil burners, refrigerators, etc., has been announced by Ward Leonard Electric Co., Mount Vernon, N. Y. The new Bulletin 109 relay is essentially a potential device which operates over a wide range of voltages.

It is stated to be chatterless because of a new magnetic circuit design. Contacts are single pole, normally closed and suitable for operating 1-hp. ca-

WHY FIBERGLAS TAPE IS USED ON *Induction Furnace Coils*

In metal-melting furnaces, high temperatures create tough insulation problems. For example, around the Fiberglas-insulated coils, in the furnaces made by the Ajax Engineering Corporation, Trenton, N. J., temperatures are in excess of 300° F. from radiation and conduction alone. And the internal heat from the coil itself boosts the operating temperature considerably higher.

Tape woven from Fiberglas yarns, is wrapped around the copper conductors, the coils are formed, then dip-impregnated with modified phenolic high-temperature insulating varnish.

This is typical of many applications in which Fiberglas, in various forms, is being used to provide a margin of safety in electrical equipment. For Fiberglas withstands heat far beyond the temperature range of even the newer insulating varnishes. Moreover, should the impregnants burn out, the Fiberglas base still provides protection as a permanent spacer.

Fiberglas Electrical Insulating Materials are available in forms to meet practically every insulation need. If you are concerned with the design, manufacture, use or maintenance of electrical equipment, get all the facts about Fiberglas Electrical Insulations. Write for catalog EL46-11—Owens-Corning Fiberglas Corporation, Department 858, Toledo 1, Ohio. Branches in principal cities.

In Canada: Fiberglas Canada Ltd., Toronto, Ontario.

OWENS-CORNING
FIBERGLAS
T.M. REG. U.S. PAT. OFF.

ELECTRICAL INSULATING MATERIALS

TAPES • CLOTHS • BRAIDED SLEEVING • VARNISHED TUBING • MICA COMBINATIONS • LAMINATES

%+%+%+%+% Recovery...

the crux of dust separation

"Know Your Dust," says Buell. 999 times out of a thousand, the percentages of various micron sizes establish a complex separation problem. To anticipate satisfactory separation you must know with just what efficiency your collection apparatus will handle each of the different size particles present.

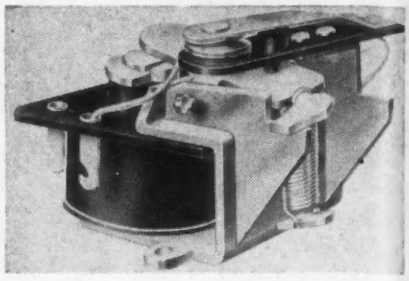
A Buell Fractional Efficiency curve will tell the complete story. Not a round-figure overall promise, but an analytical certification of performance on each of the sizes of your total dust.

Buell engineering can tailor equipment to your most exacting demands. And, instead of being complex, the layout will be relatively simple, the diameters relatively large – and draft demand and maintenance costs low.

The Shave off is the pay off—a van Tongeren System patented feature found only in Buell equipment. The how and why of it is graphically presented in a reference catalog every interested engineer should read. Write for "The van Tongeren System of Industrial Dust Recovery", Buell Engineering Co., 70 Pine Street, New York 5, N. Y.

buell

Engineered Efficiency IN DUST RECOVERY



pacitor motors on 115 or 230-volt, 60-cycle circuits. The relays are 1½-in. high, 1¾-in. wide and 1⅛-in. long.

•

Electric Appliance Tester Is Pocket-Size Instrument

A NEW indicating instrument measuring voltage, current, and wattage of electrical appliances has been announced by the Simpson Electric Co., 5200-18 West Kinzie St., Chicago 44, Ill. The instrument is furnished with a break-in plug which has four color-coated leads. The leads are first attached to the instrument, then the plug placed in an electrical outlet and the appliance to be tested is plugged into it.

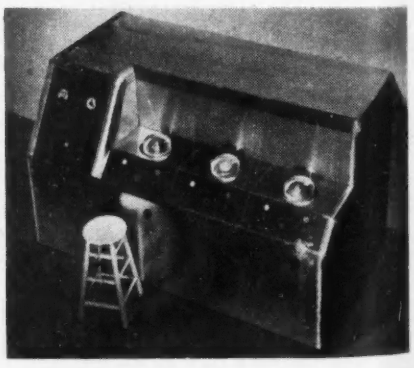
Voltage readings register immediately. Wattage and ampere readings are obtained by pressing one of two buttons at the bottom of the instrument panel.

The meter was designed for use on 60 cycles; has voltage scales from 0 to 150 and 0 to 300; has ampere scales 0 to 3 and 0 to 15; and wattage scales 0 to 300, 0 to 600, 0 to 1,500, and 0 to 3,000.

•

High Vacuum Furnace Develops 1,800° C.

FOR the heat treatment of materials which are highly reactive toward gases, a new type of high-vacuum furnace has been developed by Eitel-McCullough, Inc., 1570 San Mateo Ave., San Bruno, Calif. The unit is stated to be capable of continuous operation at temperatures in the 1,800 deg. C. region. The stand-



High Resistance to Heat, Flame, Corrosive Fumes and Moisture

Wrapped up in a Flexible Conduit

A TYPICAL ROCKBESTOS CONSTRUCTION DESIGNED TO GIVE LASTING SERVICE

The Rockbestos A.V.C. Power and Control Cable illustrated is one of many constructions designed to give failure-free performance in power and control circuits. They are also made with either lead sheath or armor coverings or asbestos braids in voltages up to 5000 with individuals insulated like this:

1. Color-coded cotton braid for circuit identification.
2. Heat, flame and moisture-resistant impregnated felted asbestos insulation that won't bake out, crack, flow or rot.
3. Asbestos-protected varnished cambric for high dielectric strength and added moisture resistance.
4. Inner wall of impregnated felted asbestos that won't bake brittle or burn under conductor-heating overloads.
5. Conductors are perfectly and permanently centered in helically applied non-flowing insulation that provides greater current carrying capacity.

One of 125 different constructions designed by Rockbestos for severe or unusual operating conditions.

Here's a Rockbestos A.V.C. cable that not only protects circuits from failing under heat and moisture and other severe operating conditions — but also increases the flexibility of your wiring systems and makes circuits more easily accessible.

Its impregnated *asbestos insulation* withstands heat, corrosive fumes, aging and conductor-heating overloads. The lead sheath protects it from condensation resulting from heating and cooling cycles, and even from immersion. The spiral bronze armor also eliminates the need for conduit, especially important in capacity expansion programs because the cable may be run in troughs, up vertical risers, over and around obstructions.

Made in power and control constructions this cable protects operations and reduces maintenance expense. Other failure-preventing Rockbestos A.V.C. constructions are described in the No. 10-E catalog. Write for your copy.

ROCKBESTOS PRODUCTS CORPORATION · 211 Nicoll Street, New Haven 4, Conn.

ROCKBESTOS A.V.C.

The Wire with Permanent Insulation

NEW YORK BUFFALO CLEVELAND DETROIT
CHICAGO PITTSBURGH ST. LOUIS
LOS ANGELES SAN FRANCISCO SEATTLE PORTLAND, ORE.

Two IMPORTANT O.K.'s for this BETTER pole treatment

After years of thoroughgoing test, the facts are proving that Chapman "Penta" Preservative is, on all counts, the most satisfactory treatment for your poles which is available today.

Linemen and others who must work on and with poles prefer this clean treating material, because there's nothing sticky or unpleasant about Chapman "Penta" Preservative.

Actual tests by the Forest Service of the U. S. Department of Agriculture show pentachlorphenol superior in decay and termite resistance to any of the 21 other preservatives—including creosote—used in their 10-year-old exposure experiments. That means lower maintenance costs for you.

Chapman "Penta" Preservative treatment costs no more than creosote, and can be obtained in any part of the United States. Write us for details.

CHAPMAN

CHAPMAN CHEMICAL COMPANY
333 North Michigan Avenue, Chicago 1, Illinois

Chapman "Penta" Preservative contains *Pentachlorphenol*
a product of
The Dow Chemical Company

ard type consists of three chambers integrated into a single enclosed cubicle as illustrated. Cycling circuits are incorporated so one chamber can be in the treatment phase while one is under preliminary pumping and a third is being reloaded.

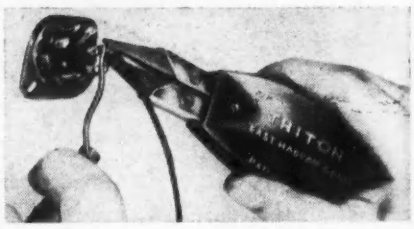
The manufacturer reports that the furnace is capable of attaining a production vacuum as high as 5×10^{-6} mm. of mercury. Heating of the furnace is accomplished by tungsten elements. The unit has a demand of 15 kw. and a total treating capacity of 175 cu. in.

Interlocking safety devices are provided to protect the furnace parts against temperature extremes and the heating filaments against burnout from operating at too high a gas pressure. Program timers control the operating cycle and provide a means of presetting the treatment routine.

•

New Soldering Tool Has Plier-Like Electrodes

A NEW soldering tool, called Press-To-Heat, designed for special soldering operations, is being introduced by



Triton Mfg. Co., East Haddam, Conn. It operates from alternating current, uses a 6-volt transformer and heating unit, and is about the size and shape of an electric shaver.

A spring-actuated lever, when compressed, closes two plier-like carbon electrodes on the parts to be soldered. By further compressing the actuating lever, the current is switched on for the short period required to melt the solder. Slight release of the lever cuts off the current and permits the work to be held between the jaws until the solder has cooled.

•

New Electrode Developed For Cast Iron Welding

A NEW all-position electrode, No. 575, with a high nickel core wire and a heavy extruded coating has been developed for use on cast iron by Wilson Welder & Metals Co., Inc., 60 East 42nd St., New York 17, N. Y. Ordinarily, preheating is unnecessary, the manufacturer reports.

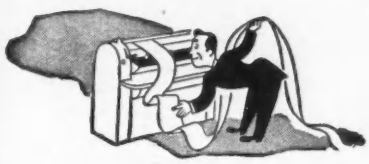
Welds are reported to be machinable

NEW! THE OZALID STREAMLINER

• Reproduces your engineering and architectural drawings in seconds—also your typed, printed, photographic material.

• Moderately priced . . . designed for the thousands of drafting rooms that want these 5 EXTRA VALUES in Printmaking at no extra cost—

1. EFFICIENCY! You always get positive (not negative) prints direct from your tracings . . . prints that are sharper, brighter, much easier for you to read, check, and make notations on.



You produce these without waste of material or waste of motion. Your tracings can be up to 42 inches wide, any length . . . and can be printed either on rolls of Ozalid sensitized paper or on cut sheets of matching size.

Your prints are always delivered dry, ready for immediate use . . . after just two simple operations—Exposure and Dry Development.

2. SPEED! ONLY 25 seconds to reproduce your standard-size tracings, specification and data sheets, etc.

3. ECONOMY! An 8½ x 11-inch reproduction costs you *one cent;* 11 x 17 inches, two cents . . . and so on. The Ozalid Streamliner soon pays for itself . . . in time, labor, and dollars saved.

With it, you can also effect amazing short cuts in design. For example—eliminate redrafting when changing obsolete drawings . . . combine the details of separate tracings on *one* print . . . re-

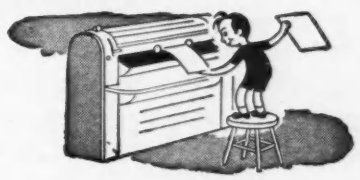
claim old or worn tracings . . . make transparent overlays in different colors.

4. VERSATILITY! You can reproduce the lines and images of any original in black, blue, red, sepia, or yellow . . . on paper, cloth, foil, film, or plastic.

Simply use the Ozalid sensitized material you think best for job at hand; e.g., use identifying colors for prints of separate departments or operations . . . DRYPHOTO to produce beautiful con-

tinuous-tone prints from film positives (which can be made from any negative) . . . OZAPLASTIC to produce oilproof, waterproof prints for shop or field use. *All* prints are made in same fast, economical manner.

5. SIMPLICITY! NOW—printmaking is an easy desk job, automatic in practically every detail.



Anyone can feed originals and sensitized material into the Ozalid Streamliner. Prints are delivered on top, stacked in order—within easy reach of the operator, who does not have to leave her chair.

You can install your Streamliner anywhere; it requires only 11 square feet of floor space.

Write today for free, illustrated booklet . . . showing all the ways you can use the new OZALID STREAMLINER . . . and containing actual reproductions — like those you can make.

Gentlemen: DEPT 267
Please send New Ozalid Streamliner booklet . . . containing reproductions of drawn, typed, printed, and photographic material. No obligation.

Name_____

Position_____

Company_____

Address_____

OZALID

DIVISION OF
GENERAL ANILINE AND FILM CORPORATION
Johnson City, New York

Ozalid in Canada
Hughes Owens Co., Ltd., Montreal

—here's how to SAFEGUARD it!

Rush carbon dioxide to the scene in a *Kidde* Trailer

No quicker way than a *Kidde* Trailer Unit to get your fire-fighting equipment to the scene of remote blazes—like those in underground cables. And no quicker way than carbon dioxide to *kill* the fire!

Just discharge the carbon dioxide from the Trailer Unit down the manhole nearest the fire. The carbon dioxide swiftly works its way through the cable ducts—to smother the fire wherever it started.

Remember . . . carbon dioxide is dry, inert, non-conducting, clean.

Kidde Trailer Units are built to specification for *your* requirements. A typical unit carries a hose reel with a 300-pound supply of carbon dioxide, 2 *Kidde* 15-pound Carbon Dioxide Portables, and 2 *Kidde* Water Extinguishers.

Ask a Kidde representative for full details.

Walter Kidde & Company, Inc., 530 Main Street, Belleville 9, N. J.

The word "Kidde" and the Kidde seal are trade-marks of Walter Kidde & Company, Inc.

Kidde

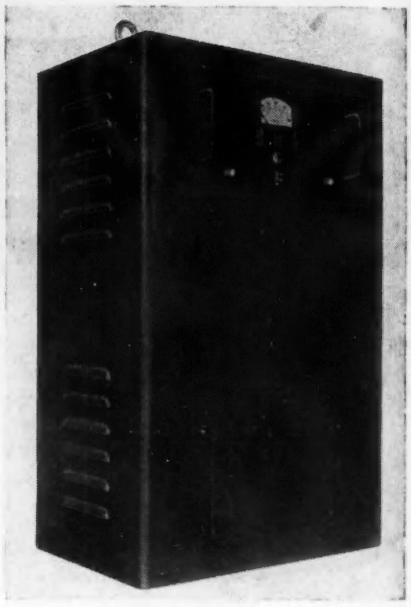
FIRE PROTECTION HEADQUARTERS

and to exhibit adequate tensile strength and ductility for cast iron welding. They are immediately available in $\frac{5}{32}$, $\frac{1}{8}$ and $\frac{3}{32}$-in. diameters. A $\frac{7}{16}$-in. diameter may be added at a later date. The electrodes may be used on either alternating or direct current.

•

New Regulator Design Has Faster Action

THE ENTIRE LINE of Stabiline (Type EM, Electro-Mechanical voltage regulators has been completely reengineered



by the Superior Electric Co., 1024 Church St., Bristol, Conn. The new design is said to offer faster detection of line voltage variations, non-microphonic performance, ease of installation and servicing and elimination of possibility of damage from shock.

All removable components such as the new voltage sensitive element and the new relays are of the plug-in type. All wiring is concealed with no exposed live parts. The power elements have been made more compact and are fitted to smaller cabinets than those of previous design, the manufacturer reports.

•

Midget Tubular Capacitors Have Humidity Protection

A NEW LINE of Midget paper dielectric capacitors, models 68P and 69P, which are stated to be the first commercially produced tubulars to operate at 85 deg. C. and to have humidity protection for normal radio and other uses, have been introduced by Sprague Electric Co., North Adams, Mass. The new units are stated to combine the new materials and processes resulting from

NATVAR *in* ARGENTINA

This ad, showing typical uses for Natvar insulating materials, was made up and used by PRODELEC, an authorized distributor for Argentina. Natvar Sales Agent for Argentina is Casa Rand, P. O. Box 942, Buenos Aires.

Natvar insulating materials are universally accepted as standard because they *stand up* in actual service. This stamina comes from painstaking manufacture and testing, so that Natvar insulation is consistently up to specification or above.

If you require insulating materials with good physical and electrical performance characteristics and exceptional uniformity, it will pay you to use Natvar. Get in touch with your distributor, or write us direct.

Natvar

Natvar Products

- Varnished cambric—straight cut and bias
- Varnished cable tape
- Varnished canvas
- Varnished duck
- Varnished silk
- Varnished special rayon
- Varnished Fiberglas cloth
- Silicone coated Fiberglas
- Varnished papers
- Varnished tubings and sleevings
- Varnished identification markers
- Lacquered tubings and sleevings
- Extruded Vinyl tubing
- Extruded Vinyl identification markers

Ask for Catalog No. 20

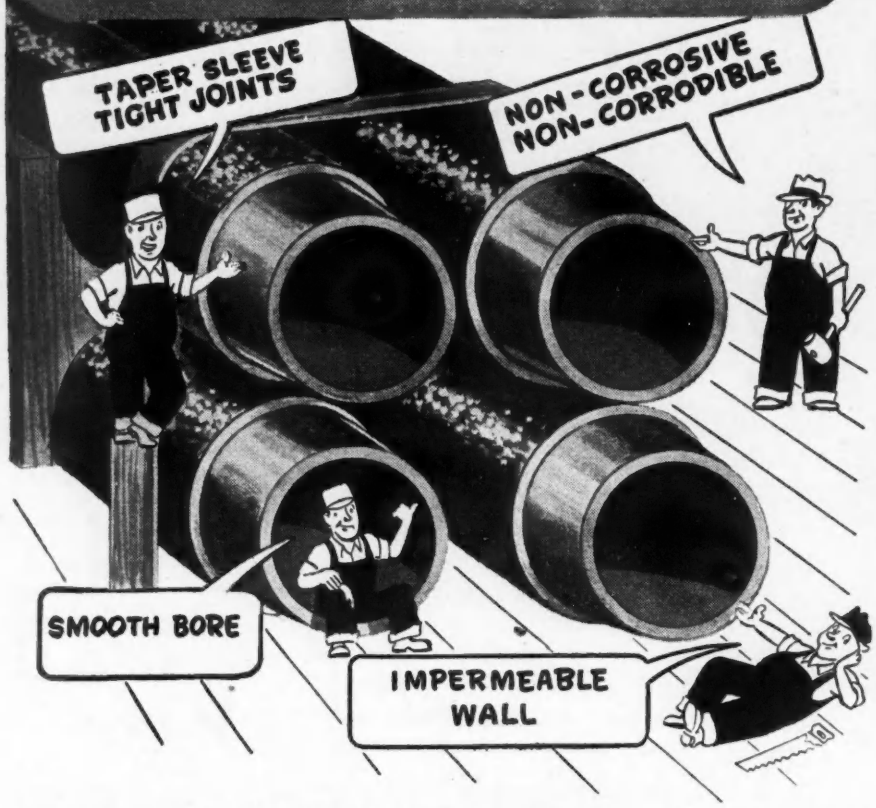
THE NATIONAL VARNISHED PRODUCTS Corporation

TELEPHONE
RAHWAY 7-2171

CABLE ADDRESS
NATVAR: RAHWAY, N. J.

221 RANDOLPH AVENUE ★ WOODBRIDGE NEW JERSEY

Will your cable be safe from SCORING? INFILTRATION? CORROSION? STRAINS?



House the cable in ORANGEBURG Conduit and it will be safe! *Safe against* SCORING *and* STRAINS . . . because ORANGEBURG'S *smooth bore* protects sheath from scoring or abrasion as cable is pulled into duct; reduces pulling tension and cable strain; makes longer pulls possible. *Smooth bore* and *less friction* also reduce wear with cable movement under load. *Safe against* INFILTRATION *and* CORROSION . . . because ORANGEBURG'S *impermeable walls* and *tight* TAPERWELD *joints* keep out ground waters and corrosive elements. Write *today* for the interesting, fully informative ORANGEBURG Catalog.

THE FIBRE CONDUIT COMPANY • ORANGEBURG, N. Y.
Graybar Electric Co., Inc. • *Distributors* • General Electric Supply Corp.

*Reg. U.S. Pat. Off.

ORANGEBURG

WITH 50 YEARS EXPERIENCE IN THE MANUFACTURE OF NON-METALLIC CONDUIT AND PIPE, SERVES THE POWER AND LIGHT, TELEPHONE, GENERAL CONSTRUCTION, CHEMICAL, PETROLEUM, PLUMBING AND BUILDING SUPPLY FIELDS WITH ELECTRICAL FIBRE CONDUIT . . . ELECTRICAL UNDERFLOOR DUCT SYSTEMS . . . AND FIBRE PIPE FOR NON-PRESSURE USES.

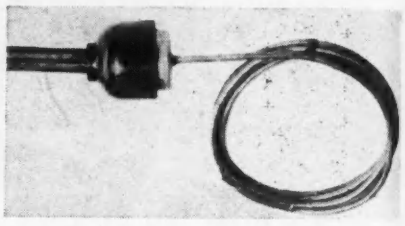
the company's development of small capacitors for the proximity fuse and other miniature war-time assemblies.

The new units are stated to meet the proposed RMA humidity and voltage tests. Type 69P have side leads to allow wiring them across the sockets of miniature tubes. Type 68P units have conventional end leads.

•

Alarm Switch Design For Freezer Units

A NEW low-voltage electrical alarm switch designed to warn of mechanical difficulties in commercial and home



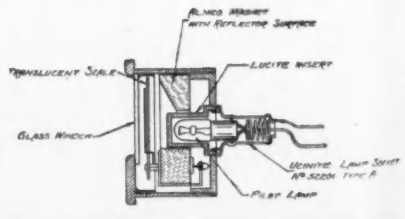
freezers has been developed by Cutler-Hammer, Inc., 235 North 12th St., Milwaukee, 1, Wis. The new switch was designed primarily for installation in remotely located freezers. It can operate a bell, light or buzzer whenever temperature in the freezer rises to a predetermined danger point. The switch is about the size of an acorn and contains a thermostatic element and the contact mechanism.

•

Lucite Utilized in Lighting Instrument Panel

MARION Electrical Instrument Co., Manchester, N. H., has introduced a new technique in instrument dial illumination. The new design is applicable to all the company's 2½ and 3½-in. round and square instruments, the 4½-in. rectangular instrument and the Model 52S.

A cross-section view of an instrument

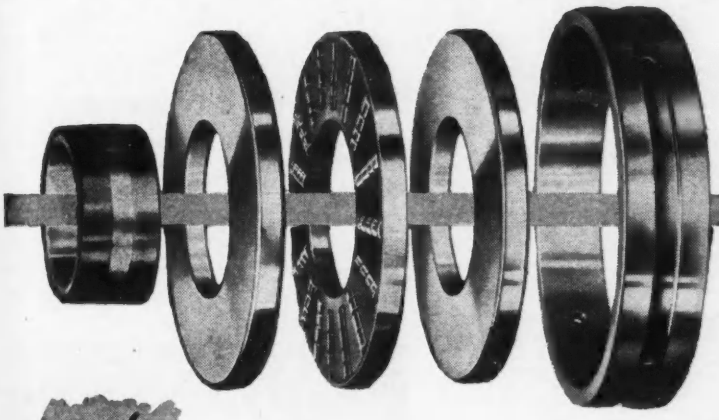


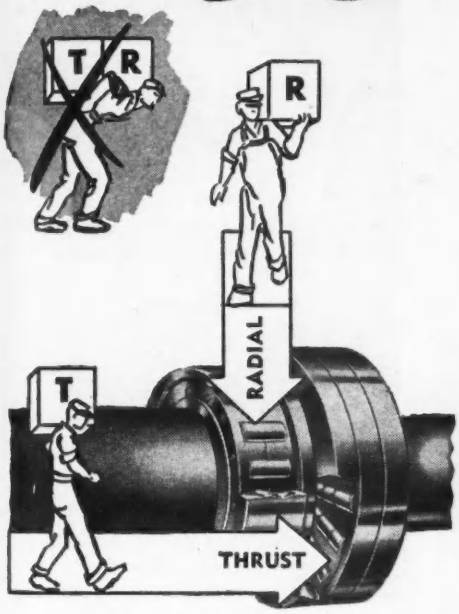
utilizing the new design is shown. It utilizes a transparent Lucite cavity which is said to seal the opening against dust, and at the same time provide evenly distributed illumination on the instrument dial.

SPLIT YOUR LOAD IN TWO !

with

ROLLWAY
RIGHT-ANGLE-LOADED
BEARINGS

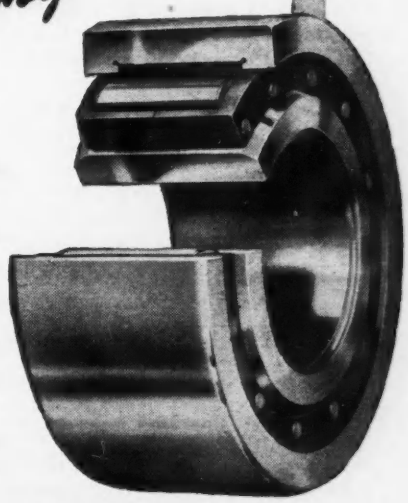




Right-Angle Loading splits compound loads into the two component parts of pure radial and pure thrust... and carries each of these components on separate bearing assemblies. Simple but scientifically sound.

1. **Keeps bearings free of complicated stresses**
2. **Gives longer bearing life with higher capacity**
3. **Cuts maintenance cost and lay-up time**

What Right-Angle-Loading Does!



1. Prevents wedging of rollers and pinch-out. Reduces roller end-rub, with its wearing friction. Holds starting and operating torque at a minimum.
2. Since only pure radial or pure thrust loads can be imposed upon any single bearing assembly, unit pressures are reduced substantially.
3. Since all loads are carried at right-angles to the roller surface, compound or oblique loads are avoided and so are the resultants of the oblique loads.
4. Right-angle loading permits greater radial or thrust load-carrying capacity in any given dimension.
5. Right-angle loading assures solid cylindrical rollers of greater roller mass and uniform roller cross-section . . . greater resistance to shock loads and vibration . . . longer life expectancy under continuous heavy-duty service.

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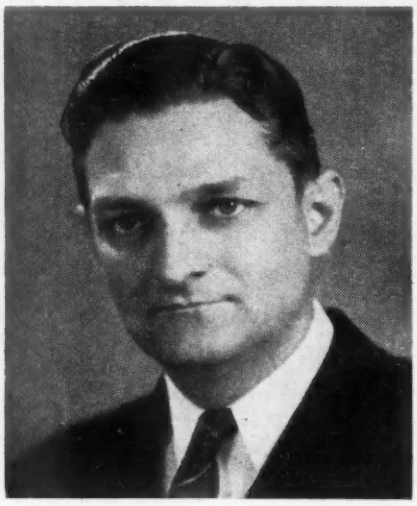
NEWS ABOUT PEOPLE

Southwestern Utility Names Graham Vice-President

Edgar F. Graham has been named vice-president and manager of the East Texas division of the Southwestern Gas



E. F. GRAHAM

& Electric Co., succeeding the late Knox Lee. Mr. Graham, who will move to the division offices in Marshall, Tex., has served as assistant to the president for the past five years.

Mr. Graham first became associated with the predecessor to Southwestern Gas & Electric Co. in Marshall in 1925. He later went to Texarkana, then to Dallas, and in 1932 to Shreveport to the general offices of the company. He has been head of the company's rate department for ten years.

•

▶ CLAYTON A. MILLER, budget director of the New York Power & Light Corp., Albany, N. Y., has been named chairman of the National Society of Professional Engineers membership committee, covering the Atlantic Seaboard states in the northeastern area of the United States. Since 1933 Mr. Miller has been actively engaged in various phases of budget work in the eastern division of the Niagara Hudson System.

▶ JOHN C. COSTELLO, for the past seven and one-half years in charge of advertising for Ohio Edison Co., has been named assistant to President Walter H. Sammis. Following graduation from the University of California, Mr. Costello entered the employ of the Chattanooga (Tenn.) Railway & Light Co. as a power salesman. During more than 25 years in the utility business he has engaged in power, lighting, merchandise and securities sales, and in advertising and publicity work. He became advertising manager of what was then the Tennessee Electric Power Co. in 1923 and joined the Ohio Edison organization in 1939.

•

National Rural Co-op Group Elects Craddock Head

T. E. Craddock, city manager of Seymour, Tex., and manager of the B-K Electric Cooperative, serving some 1,800 customers in three west Texas counties, was elected president of the National

T. E. CRADDOCK

Rural Electric Cooperative Association at the convention held recently in Spokane.

Mr. Craddock succeeds J. C. Nichols of Cody, Wyo., president for the past two years.

•

▶ JOHN E. HUNTER, senior engineer with the Carolina Power & Light Co., has been named distribution engineer for western North Carolina to succeed ROBERT G. FORTUNE, recently promoted to general operating superintendent. Hunter has been with the company for nine years.

Warren Made Engineer, G.E. Turbine-Generator Div.

Arthur R. Smith, who during his 50-year career in the electrical industry has been responsible for many major advancements in design and efficiency of steam turbines for land and marine

G. B. WARREN

use, retired on May 1 as managing engineer of the General Electric turbine-generator engineering division. He has been succeeded by Glenn B. Warren as engineer of the division. Mr. Warren has been designing engineer of the same division since 1932.

Mr. Warren, who has been associated with Mr. Smith for many years and whose developments, as designing engineer, have been closely connected with Mr. Smith's work as managing engineer of the department, joined G. E. in 1918, but returned to the University of Wisconsin to obtain a degree of B. S. in mechanical engineering the same year. He rejoined G. E. in 1919 as a member of the student engineering course and entered the turbine engineering department the same year. Much of Mr. Warren's work has involved the planning of new turbine designs. In the period from 1928 to 1931, he was associated with the development of new type of high-speed turbine for merchant marine propulsion. In succeeding years, basing his studies on the merchant marine turbine, he was instrumental in the development of a new type turbine for propulsion of the main combatant ships of the U. S.

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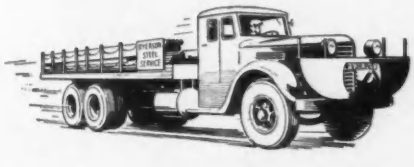

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Navy, which development was described by one Secretary of the Navy as the "greatest progress the American Navy has made in engineering in a generation." During World War II, Mr. Warren also had general design supervision over the group of engineers who designed G. E. aircraft gas turbines. Author of many technical articles, he is a fellow of the American Society of Mechanical Engineers, a member of the American Society of Naval Engineers and of the Society of Naval Architects and Marine Engineers.

The position of managing engineer has been held by Mr. Smith for 17 years and, until a year ago, he also served as manager of the construction engineering division. He became associated with the General Electric Co. in 1897 as a worker in the blueprint department of the Schenectady Works. After serving in the switchboard engineering department and the railway traction engineering departments, he organized the construction engineering department in 1909. During the next 21 years, before becoming managing engineer of the then turbine-generator department, Mr. Smith's work took him to far corners of the world. In 1930 he assumed responsibility for the development of the mercury-cycle turbine and designed two major plants, one at Kearny, N. J., and one at Schenectady.

Author of many technical publications, Mr. Smith is a fellow of the American Society of Mechanical Engineers and a member of the Society of Naval Architects and Marine Engineers.

•

U. S. Chamber of Commerce Elects Shreve President

Earl O. Shreve, vice-president of the General Electric Co., was elected president of the U. S. Chamber of Commerce at the annual meeting held last week in Washington, D. C. Mr. Shreve has been serving as a member of the staff of President Charles E. Wilson since 1945 and has been identified with G.E. since 1904.

He is a past-president of the National Electrical Manufacturers Association and was elected a member of the board of directors of the U. S. Chamber of Commerce in 1943.

•

▶ GEORGE QUINAN, chief consulting engineer for the Puget Sound Power & Light Co., has retired. He entered the industry following his graduation from the University of California in 1903. He worked for a number of utilities in Washington state before joining Puget Sound of which he became chief electrical engineer in 1919, chief engineer

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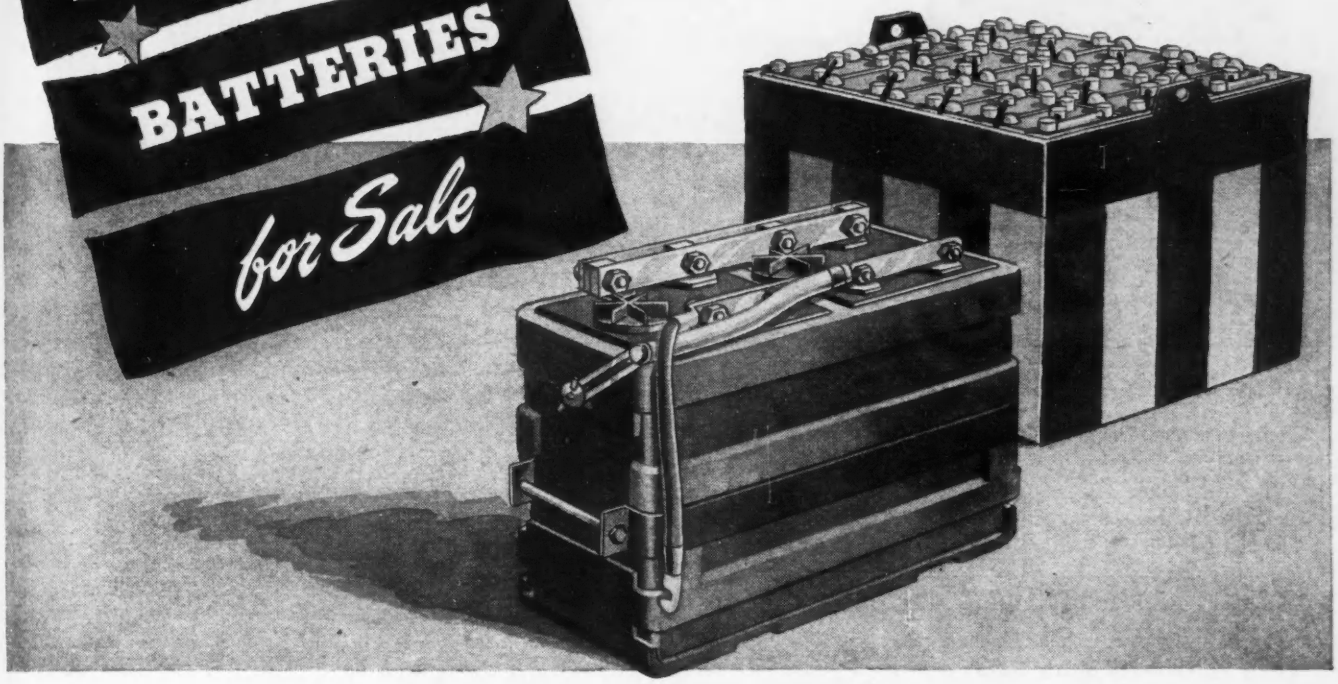

Heavy duty batteries are still hard to get on the open market—but now many are available at WAA offices in:

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Some unused batteries are also being offered at low fixed prices. To receive listings, write one of the above offices and ask to be placed on the industrial battery mailing list.

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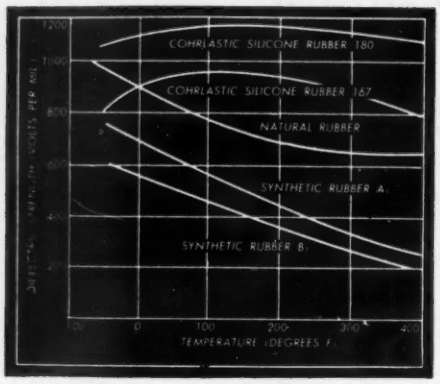

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CROSBY CLIPS
than all other drop-forged fasteners

in 1935, and chief consulting engineer in 1942. He served a term as a vice-president of the American Institute of Electrical Engineers.

•

Rives Matthews Assigned New Executive Duties

Announcement has been made of the appointment of Rives Matthews as assistant to the president of the W. N. Matthews Corp., St. Louis. At the same time, Mr. Matthews, together with James E. Handel, were elected to the corporation's board of directors.

Mr. Matthews joined the organization in 1946, after spending 20 years in the newspaper publishing business.

Mr. Handel has been connected with the Matthews Corp. since 1924 and at the present time is occupying the position of superintendent of production and purchases.

OBITUARY

Marion A. Savage

Marion A. Savage, consulting engineer for the General Electric Co., who received international recognition for his design of large turbine generators, died on April 9 at his birthplace, Waterboro, S. C., where he was on vacation from his home in Scotia, N. Y. He was 62 years old. After joining General Electric Co. he obtained experience in eleven different departments and then was assigned to the alternating-current engineering department. Mr. Savage was named head of the turbine-generator section in 1923, and eight years later became designing engineer of the alternating-current engineering department. The following year he was appointed design engineer of the turbine-generator section. For the past several years he had served as consulting engineer in the turbine-generator engineering department at Schenectady.

Indicative of his many achievements was his winning of the 1938 Lamme Gold Medal, awarded annually by the American Institute of Electrical Engineers. He was cited for the success of the hydrogen-cooled turbine generators built under his design. Author of numerous technical papers, one of which was presented at the World Power Conference in Berlin in 1930, he was also holder of a large number of patents relating to the construction of turbine-generators.

•

▶ GORDON G. SPENCER, manager of the Eastern Light & Power Co., Ltd., Sydney, Nova Scotia, since its inception in

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STANDARD HANDBOOK for ELECTRICAL ENGINEERS

Archer E. Knowlton, Editor-in-Chief
Associate Editor for Engineering, Electrical World

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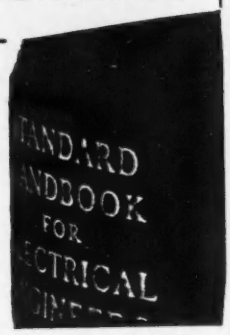

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1931, died suddenly on March 14. For 28 years preceding his association with Eastern Light & Power Co., Mr. Spencer was connected with its predecessor, the Cape Breton Electric Co. Ltd.

•

Martin J. Insull

Martin J. Insull, brother of the late Samuel Insull and long associated with him in the utilities system which crashed 15 years ago, died on May 4 at Orillia, Ont., Canada, where he had been living for a number of years. He was 78 years old.

Martin Insull was president of the Middle West Utilities Co. organized by Samuel when it collapsed in 1932. Born in Reading, England, he came to America in 1887 and was graduated in mechanical engineering from Cornell University in 1893.

On leaving college he spent five years with Sargent & Lundy and then started the Martin J. Insull Co., manufacturers' agents.

From 1898 to 1904 he was general manager of the General Incandescent Arc Light Co. of New York. Two years later he was sent by his brother to New Albany, Ind., as vice-president of the United Gas & Electric Co., the Louisville and Northern Railway & Light Co., and the Louisville and Southern Indiana Traction Co.

When these and other companies were merged into the Middle West Utilities Co. in 1912, Mr. Insull was made senior vice-president, a position he held for 12 years and in this capacity he was actively in charge of operations. In 1924 he assumed the presidency. As operations head of this organization, Martin Insull at one time directed the distribution of electric power to small towns and rural areas in 30 states, in a region extending from Maine to Texas and from Georgia to Utah.

•

▶ Clifford B. Hayes, some years ago connected with the utility industry in Florida, died on April 7 while enroute from his home in Avon Park, Fla., to a hospital in Philadelphia. He had been in ill health for more than a year. Mr. Hayes entered the utility field in 1905, when he joined the Ice & Power Co. at Lake Wales. When this company was taken over by Florida Public Service Co. in 1924 he was made district superintendent. Later he served the company in Orlando.

▶ Benard S. Hallberg, sales manager of the Chicago district of the Trumbull Electric Manufacturing Co., Plainville, Conn., died on April 15.

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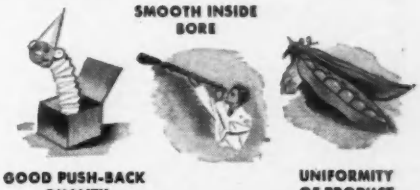

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MANUFACTURERS & MARKETS

Electrical Equipment and Appliance Sales Increase 35% in 1946 Fourth Quarter

Electrical equipment and allied product sales in the fourth quarter of 1946 increased 35 percent over the third quarter, according to figures obtained recently from the Securities and Exchange Commission. Listed are 24 equipment manufacturers whose billings increased 38 percent; 17 appliance manufacturers, 20 percent; 5 non-ferrous metal refiners, 26 percent; and 8 non-ferrous metal products manufacturers, 12 percent.

Total sales for the 54 manufacturers heavily interested in the electrical industry were $772,969,000 in the third quarter and $1,029,239,000 in the fourth quarter. The $256,270,000 gain represents an increase of 35 percent in sales volume. Third and fourth quarter sales and percent gain for other group classifications were: 17 appliance manufacturers, $62,544,000, $75,251,000, 20 percent; 5 non-ferrous metal refiners, $166,726,000, $224,898,000, 26 percent; and 8 non-ferrous metal products manufacturers, $92,417,000, $106,089,000, 12 percent.

The figures indicate that equipment for generation, transmission, distribution and control are being produced in increasing quantities over the current consuming appliances. The overall increase appears to be due to the gradual easing of shortages and more settled labor conditions. The increased sale of non-ferrous metals and non-ferrous products appears to indicate a gradual easing of these critical materials and parts.

Sales Data ($1000)

General Equipment Group	*3rd Quarter*	*4th Quarter*
Allis Chalmers Mfg. Co.	12,214	30,016
Cable Electric Products, Inc.	610	547
Century Electric Co.	3,647	4,314
Clark Controller Co.	1,589	1,796
Duro Test Corp.	783	902
Electric Controller & Mfg. Co.	952	1,223
Electric Products Corp.	1,026	1,028
Emerson Electric Mfg. Co.	4,337	5,053
Gamewell Co.	2,149	2,325
General Electric	253,620	342,384
Harvey Hubbell, Inc.	1,334	1,218
Kellogg Switchboard & Supply Co.	6,018	8,695
Line Material	6,583	8,487
Master Electric	2,890	3,488
Minneapolis-Honeywell Regulator Co.	11,678	15,440
Noma Electric Corp.	9,777	13,294
Ohio Brass Co.	2,822	3,237
Penn Electric Switch Co.	1,761	1,860
Reliance Electric & Engineering Co.	3,015	3,668
Sangamo Electric Co.	2,543	2,996
Square D Co.	7,365	8,436
Wagner Electric Corp.	10,993	13,464
Westinghouse Electric Corp.	100,717	146,033
Weston Electrical Instrument Co.	2,849	3,127
Totals	451,272	623,001
Non-Ferrous Metals Group	*3rd Quarter*	*4th Quarter*
American Smelting & Refining Co.	44,700	57,000
Kennecott Copper Corp.	42,647	56,809
National Lead Co.	39,779	48,758
Phelps Dodge Corp.	29,106	49,689
St. Joseph Lead Co.	10,494	12,644
Totals	166,726	224,898
Non-Ferrous Metal Products Group		
Anaconda Wire & Cable	19,862	23,439
Bridgeport Brass Co.	16,014	18,039
Callite Tungsten Corp.	705	1,084
Driver-Harris Co.	1,930	2,023
General Cable Corp.	20,093	21,604
Philadelphia Insulated Wire Co.	349	533
Revere Copper & Brass, Inc.	29,743	34,925
Rome Cable Corp.	3,721	4,443
Totals	92,417	106,089
17 Appliance Manufacturers	62,554	75,251

•

All Employees Receive Pay Increases at Allis

A wage increase of 11½ cents per hour and six paid holidays for production workers and a $20 per month increase for salary employees were placed in effect May 1 at West Allis Works, Allis-Chalmers Mfg. Co., Walter Geist, president, announced this week. Geist stated that the adjustment was "in line with the national trend" and would be effective immediately for employees not covered by collective bargaining agencies.

The same offer was made to unions with contracts at the company's eight plants where it is subject to union acceptance. The new rates will increase the payroll approximately $7,000,000 and will affect 27,000 employees.

•

Manufacturers Make Sales Assignments

Electrical manufacturing companies have recently made the following appointments to their sales staffs.

RAILWAY & INDUSTRIAL ENGINEERING Co., Greensburg, Pa., has announced the appointment of George M Meriwether as sales representative, covering the eastrn part of Mississippi, the entire state of Alabama and and the nothwestern part of Florida, with headquarters in Birmingham, Ala. J. J. Butler has been named sales representative of the company, covering most of Texas and all of Louisiana, with headqaurters in Dallas, Tex.

WHEELCO INSTRUMENTS Co., Chicago, has appointed E. W. Heffernan manager of the new Philadelphia sales and service office.

DUNCAN ELECTRIC MFG. Co. has announced the new office location of F. L. Pavey, district manager, 29 North Broad St., Ridgewood, N. J.

EMERSON RADIO & PHONOGRAPH CORP., New York, has announced the appointment of Melvin A. Prottas of New London, Conn., as a sales representative in the New York

State territory. His territory will include Rochester, N. Y.; Buffalo, N. Y.; Erie, Pa.; Syracuse, N. Y.; Albany, N. Y.; and Springfield, Mass.

BRIGHT LIGHT REFLECTOR CO., INC., Bridgeport, Conn., has appointed two new sales representatives. Harry A. Miller, Dallas, Tex., will cover the states of Arkansas, Oklahoma and Texas and Donold S. Gleason, Seattle, Wash., has been assigned a territory embracing Idaho, Oregon and Washington.

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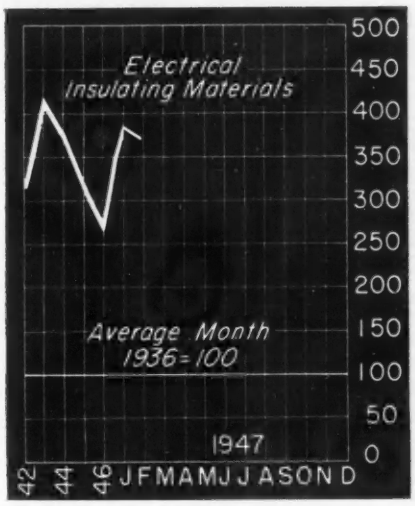
Insulating Materials Sales Advance 99% Over '46

Sales billed on electrical insulating materials during the month of February dropped slightly under the total recorded for the month of January, according to figures released by the National Electrical Manufacturers Association. The index compiled by NEMA



dipped to 373 from 388 in January, but advanced sharply from February, 1946, when it stood at 187, this year's figure representing an increase of 99 percent.

The monthly index of orders received of motors and generators is being revised, NEMA has announced, to a quarterly basis and will be released quarterly beginning with the first quarter of 1947.

•

Sets Up New Sales Policy

Industrial Timer Corp., Newark, N. J., has announced a new sales policy under which the company will now sell a complete line of industrial and photographic timing equipment direct to retailers and end-product manufacturers. The policy thereby increases prices or eliminates jobbers and distributors. Sales offices in New York, Philadelphia, Boston, Cleveland, Detroit, Chicago, St. Louis, Kansas City, Pittsburgh, Buffalo and Atlanta have been established to serve the retailer.

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because you wanted it.

All Simplex-ANHYDREX Underground Cables now have a neoprene jacket and they have it because you asked for it.

For you, a neoprene jacket on ANHYDREX cables means that you can use the cables underground with or without ducts, or you can run them up poles, or you can string them from messenger wire without having to stock a number of different kinds of cable. Neoprene jackets or sheaths aren't seriously affected by sunlight, by ozone, by heat or flame. They have excellent abrasion resistance and are oil resistant.

If you want to know more about the fine qualities of Simplex-ANHYDREX Underground Cables, we will be glad to send you a copy of the new edition of the ANHYDREX Underground Cable book, dated April, 1947. Write for Bulletin 985-A.

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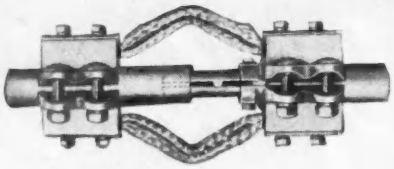
DOSSERT CONNECTORS



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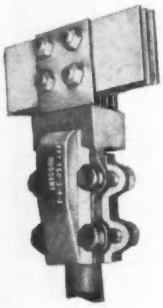

TYPE FPT

A TEE CONNECTOR FOR TAPPING A MULTI-FLAT BAR CONDUCTOR WITH A TUBULAR BUS. AVAILABLE IN ALL COMBINATIONS OF FLAT BAR BUSES AND PIPE TAPS.

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Recent Rate Changes

GULF PUBLIC SERVICE CO., New Iberia, La., has been ordered by the state Public Service Commission to reduce its electric rate schedule not less than $100,000 annually. Reductions became effective after the April 15 meter reading.

EL PASO (TEX.) ELECTRIC CO. has reduced electric power rates for residential users in Sierra Blanca, Van Horn, and the territory between the two towns to rates on par with those in El Paso. The reduction, which also applies to commercial users, was made possible by the dismantling of a diesel generation plant at Van Horn and the installation of a $76,000 transmission line from Fabens to Van Horn. Reductions in the rates are as follows: from $2 to $1.50 for 20 kw.-hr. monthly; from $2.60 to $2.25 for 50 kw.-hr.; from $4.30 to $3.75 for 100 kw.-hr.; from $5.30 to $4.75 for 150 kw.-hr.; from $6.30 to $5.75 for 200 kw.-hr.

TAMPA ELECTRIC CO. has cut its electric rates $635,000 a year and will refund to its customers $1,900,000 under the findings of the Tampa Utility Board.

KEY WEST UTILITY BOARD has passed the ordinance which sets up a new rate schedule. Under the new schedule domestic consumers will receive from 2.9 to 26.3 percent reduction in their monthly bills. The largest cut to commercial users will be given to those establishments using from 50 to 1,500 kw.-hr. These consumers will receive an average reduction of 10 percent. Those consuming more than 1,500 kw.-hr. will not receive so large a reduction. The domestic consumer who now uses 35 kw.-hr. per month pays $3.33. His new bill will be $2.95, or a reduction of 11.4 percent. The householder who uses 50 kw.-hr. a month now pays $4.23, but will be assessed $4 under the new rate.

NEW YORK STATE ELECTRIC & GAS CORP. has been authorized by the Public Service Commission to put into effect revised schedules for electricity which will result in an annual reduction of approximately $173,000 to residential and small commercial consumers in five counties in the western part of the state. The reduction became effective May 9. In the Lockport district, Niagara County, the minimum charge will be reduced from the existing $2 per month to 75 cents per month for consumers outside the City of Lockport. In the Lancaster district, including numerous communities in Erie, Wyoming, Cattaraugus and Chautauqua counties, the minimum monthly charge will be reduced by 15 cents. In the monthly minimum charge there is an allowance of 11 kw.-hr. of electricity in the Lockport area and 10 and 11 kw.-hr. in the two areas of the Lancaster district. The existing charge per kilowatt-hour for consumption in the second block, that is, after the initial allowance, is 4 cents per kilowatt-hour. Under the new filing, the rate in this block for use up to 60 kw.-hr., will be reduced to 3.5 cents per kilowatt-hour.

•

New Ontario Project

The Ontario Hydro-Electric Power Commission plans to have the Pine Portage Falls project on the Nipigon River underway in 1948. The first unit will have a capacity of 40,000 hp.; ultimate capacity is to be 160,000 hp.

Flexo has the answer to your flexible wire and cable problems with its important feature of "Controlled Flexibility." Every uninsulated strand of Flexo wire and cable is uniformly flexible. This means improved performance for your movable electrical parts. For further information write today and ask for catalog #62.

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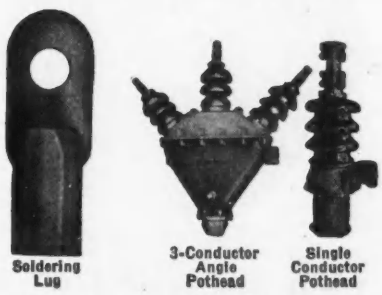

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LETTERS TO THE EDITOR

Atomic Promise

To the Editor of ELECTRICAL WORLD:

I have just read the special insert in your March 15 issue entitled "Atomic Energy—Its Future and Yours." As an officer of a company furnishing a lot of the essential equipment to the Atomic Energy project, and knowing some of the inside both of its past and present, I want to compliment you on an excellent job. Your report is outstanding for compressing a large amount of essential information into a small space. It is notable for what it leaves out as well as for what it tells. The first four paragraphs of your editorial on page 101 are remarkable in putting a complicated story into simple words, and the fewest possible words at that.

I was particularly interested in the instrument chart reproduced on page 105, this chart showing the level of activity in the first atomic pile on December 2, 1942. It was of this chart that Fermi uttered the now famous words "The curve will not level off!" The reason for my concern is that this chart comes from an Esterline-Angus recorder. Who could help but be thrilled to know that a product of his company was the official witness of the birth of the Atomic Age?

I fear that a good many engineers do not yet have the imagination to realize the tremendous changes that the availability of atomic energy is going to work in our civilization, during the next 50 years. We are surrounded by so many wonders and man-made miracles, that we become blasé, and it is difficult to appreciate when a whole new epoch is born, or to appreciate its endless possibilities. That new epoch began on December 2, 1942.

To me, one of the most fascinating possibilities lies not in the field of power, but in the field of one of the research uses of the tracer isotopes. Man, like all animals, is a parasite, unable to create his own food. Only green plants, in the presence of sunlight, can take from the air our waste products, carbon dioxide and water vapor, and synthesize them into starches and sugars, the basic foods of all living things. We know this is done by chlorophyl, but as to how, we know very little. The process is so complicated it has so far evaded the studies of the best research men.

I think there is a good possibility that the use of tracer isotopes or "tagged atoms" will eventually enable us to

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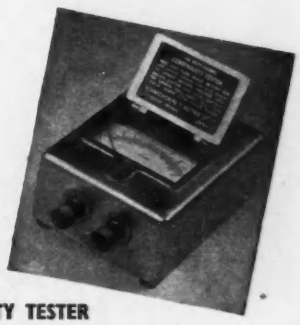

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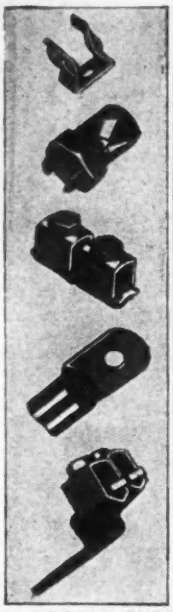

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unravel this process. If it does, that opens the possibility of man being able to duplicate the process on a large scale, using artificial sources of radiant energy. If that happens, then we will have the greatest revolution the world has ever seen and one which will change the civilization in ways we can hardly imagine in our wildest dreams. Why? Because no longer will we have to farm! We will no longer be dependent upon the vagaries of the soil and weather to produce our food. Drought and crop failures will be relics of a bygone age. We will produce our food in factories, under controlled uniform conditions.

This is just one of many angles of the possible future of atomic power and atomic research. Right now, the use of tracer isotopes in research is only a byproduct, and a long way from power production. However, should the riddle of chlorophyl be solved, even the terrific storehouse of power contained within the atom may be secondary.

R. J. Kryter, Treasurer
The Esterline-Angus Co., Inc.
Indianapolis, Ind.

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What Killed The Birds?

To the Editor of ELECTRICAL WORLD:

About Mr. Evans' letter in ELECTRICAL WORLD of March 15 regarding birds killed while perching on a high tension conductor, I have seen this phenomenon before and although I have never heard a clear explanation I have a theory that this might have been caused by the ionization of the air in the vicinity of the conductor; a breakdown of the atmosphere such as might be caused by corona, producing nitrous acid when in moist air and which would become a corrosive poison if taken internally. However, one would be inclined to conclude that corona, due to excessive voltage, should have caused over-voltage relays to operate, but certain extraneous voltages on transmission lines may be sudden and just as quickly dissipated but yet exist long enough to cause the death of birds in the ionized field when air in the area would be unfit for animal inhalation and cause virtigo in the bird, which would account for the tenacious grip of claws on the wire even after death.

Understand, this is only a theory. If anyone should arrive at a more logical solution, I would be interested in it. It is apparent that there was no flashover.

W. A. Simpson
Akron, Ohio

To the Editor of ELECTRICAL WORLD:

The photograph sent in by Mr. Evans

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One of our many products designed for the electrical industry.

They protect the linemen's rubber gloves when not in use and provide a means of keeping them in easy reach when needed. Snap on back for attaching to body belt.

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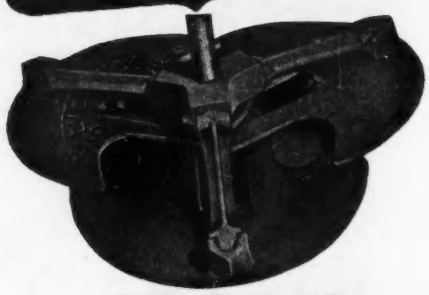

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is probably the result of a condition I have watched and waited to happen for several years, but it never did. I wonder if Mr. Evans examined any of the birds for burns.

Near my summer home is a span of construction similar to the photograph. During the early evening the birds fly in to roost for a short space of time. The weight of the birds causes the conductors to sag. The top conductor sags to the ground conductor position and the ground conductor sags equally, with the result that normal spacing is maintained. When the birds leave, the conductors whip up and usually whip in synchronism. I have seen the bottom conductor whip past the live conductor. You will note all of the birds are in a death clinch on the live conductor and none on the ground conductor. This indicates the birds left the ground conductor first. It whipped up past the birds on the live conductor, electrocuting them due to the fact they protrude out from the wire center and the current was then through their body. Some were knocked off, others froze fast.

The above may be the answer to Mr. Evans' query. The conductors do not always rise vertically; at times they rise and fall in a slight rotary motion.

Charles H. Cottle
Scranton, Pa.

To the Editor of ELECTRICAL WORLD:

Re the dead birds on Louisana Power & Light rural line, my guess is that this line is being used for carrier telephone and the birds have just heard that the late "Kingfish" Huey Long's crowd is going to make a mighty effort to install his brother Earl in the governorship come next election. The birds couldn't stand it!

R. S. Gregory
Princeton, Ky.

► We haven't heard from Georgia!—Editor

•

Leases Switch Plant

Pacific Electric Mfg. Corp. recently leased a plant in San Jose, Calif., and has started production on high voltage switches. Capacity production is expected to total $3,000,000 annually in the new plant. Robert Byrne, production control manager, heads the San Jose plant operations.

•

Utility Gets 'Oscar'

The American Public Relations Association has awarded the Wisconsin Power & Light Co. an "Oscar" for meritorious public relations performance in the field of radio.

SEYMOUR SMITH
TELEPHONE PRUNERS

CUT FASTER, COVER MORE GROUND-Keen "Center-Cut" blade slices between two strong side supports. Branch is firmly gripped, quickly cut. Ask for prices.

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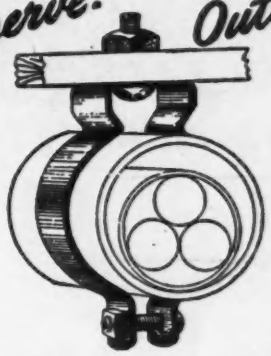

Mineralac Cable, Conduit and Messenger Hangers are STEEL. Easier, quicker to install; permit speedy, compact wiring; economical. Also in Everdur . . . Porcelain Insulating Bushings available.

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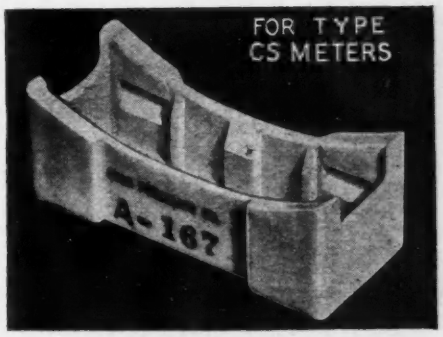

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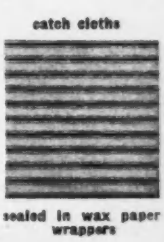

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DIESEL-ELECTRIC STEAM-ELECTRIC

FOR SALE WHERE IS, AS IS IN WHOLE OR PART
FOR OFF-SITE USE

POWER UNITS

NOW LOCATED 30 MILES NORTHEAST OF CARLSBAD, NEW MEXICO

OFFERING BASIS: Proposals for the purchase for off-site use of these facilities will be considered *in whole* or in *such parts* as separately constitute reasonably complete functional units. Except for common water cooling and air starting systems, the Diesel units constitute separate power producing units. The steam-electric facilities may be similarly considered. The water cooling tower will be offered as a unit only. Removal of facilities and restoration of premises shall be by the purchaser at his own expense.

LOCATION: 30 miles northeast of Carlsbad, New Mexico, on a spur of the Atchison, Topeka & Santa Fe Railroad; convenient for shipment by rail. The facilities are part of a plant designed for magnesium chloride cell feed production and are adjacent to the site of the plant of International Minerals and Chemical Corporation.

DIESEL-ELECTRIC UNITS: One—675 H.P. Cooper-Bessemer engine, 6 cylinder Model GMV-6, 2 cycle, 327 rpm, direct connected to a 450 kw, 0.8 p.f., 3 phase, 60 cycle, 2.4 kv generator. **Two**—900 H.P. Cooper-Bessemer engines, 8 cylinder, Model GMV-8, 2 cycle, 327 rpm, direct-connected to 2—600 kw, 0.8 p.f., 3 phase, 60 cycle, 2.4 kv generators. **Three**—875 H.P. Clark vertical engines, 8 cylinder, 2 cycle, 327 rpm, direct-connected to 3—500 kw, 0.8 p.f., 3 phase, 60 cycle, 2.4 kv generators. **One**—Air compressor, combination motor and Wisconsin gas-engine-driven, type W-13, complete with receiver tank, electric connections, pipe, valves and fittings.

All of the above engines were fired with natural gas but are complete with equipment for conversion to oil and include air starting tanks and exhaust silencers.

STEAM-ELECTRIC UNITS: One—500 kw Westinghouse turbo-generator, 0.8 p.f., 3 phase, 60 cycle, 2.3 kv, 3600 rpm, 450 psi, 500°F, noncondensing with exhaust at 50 psi. **Two**—40,000 pounds per hour, each, Riley steam generators, Type RO, 5310 sq. ft. heating surface for boiler, water walls and economizer, 500 psi and 500°F at superheater outlet, fired by Peabody, Type A-18, combination gas and steam atomizing fuel burner, convertible to oil firing, could equip with stokers, 3 steel stacks, complete with forced and induced draft fans, feed-water heater and deaerator, boiler feed pumps, and water softening equipment.

MISCELLANEOUS POWER FACILITIES: Include metal-clad switchgear complete with arresters, capacitors, 3 phase insulated bus, potheads and control panels, eight 2.4 kv generator and incoming feeder panels, one 6-unit switchboard, complete with controllers and air circuit breakers, 50 H.P. air compressor piping.

WATER COOLING SYSTEM: Includes Fluor Corporation cooling tower, Model 412A-18, aerator atmospheric spray type, 23′7″ wide, by 252′ 2″ long, by 62′ 11″ high, California redwood, with Griscom-Russell 2-pass and 4-pass Bentube sections; complete with pumps of 2000, 3500, 1000, 225 and 50 gpm driven by electric motors of 100, 100, 50, 10 and ½ H.P., respectively.

BUILDINGS: Powerhouse: One-story structural steel frame, corrugated asbestos siding and roof, steel sash windows, structural iron supports and walkways, 11,910 sq. ft., 32 feet clearance, 10 ton Shaw Box traveling crane. Cooling Water Pump House: One-story wood frame, asbestos siding and roofing, 2,585 sq. ft. Oil Pump House: One-story wood frame, asbestos siding and roofing, 168 sq. ft.

These power facilities new when placed in operation in May, 1943. Diesel-electric units shut down January 15, 1947. Use of steam-electric facilities discontinued in May, 1944.

Sealed bids in triplicate, on Uniform Bid Forms, for the offered power facilities will be received by the War Assets Administration, Office of Real Property Disposal, 728-15th Street, Denver 2, Colorado, until 11:00 A.M., M.S.T., on June 2, 1947, at which time and place all proposals will be publicly opened and read. War Assets Administration reserves the right to reject any or all proposals.

Information on how to make a bid, copies of Uniform Bid Forms, and information on these facilities can be had on request from the Denver Regional Office. Arrangements to inspect the facilities may be made, direct, through the custodian at the plant site or by the Regional Office.

1144-T

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OFFICE OF REAL PROPERTY DISPOSAL

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